The Leading Magazine in Aviation

MAY
25¢

POPULAR AVIATION

EMORY UNIVERSITY
LIBRARY
APR 5 1938
EMORY UNIVERSITY

FAIREY "BATTLES" WITH SHADOW SHADING

SEE PAGE 62 AND BACK COVER

LEONARD BRIDGMAN

★ ALONE ACROSS AMERICA—BLIND!

★ HOLLYWOOD SUICIDE CREW

OPPORTUNITY FOR YOU IN LOS ANGELES

THE AVIATION CENTER OF THE WORLD

You young men who want a career in aviation should consider the outstanding advantages California Flyers offer you in strategic location and practical, lower-cost training . . . The advantages of training in Los Angeles are overwhelmingly important and beneficial to young men who want employment *right after graduation.* We can't tell you in the small space of one advertisement about the unbelievable amount of aviation activity and opportunity for you right around our field. But there are more commercial, private and military planes flying and more planes manufactured than in any other place in the world. There is more testing of all these planes on our field by the U. S. Bureau of Air Commerce than in any other place in the world. Think of the opportunity for you in this tremendous amount of activity! Think of the advantages of taking your training at California Flyers in the very hub of activity.

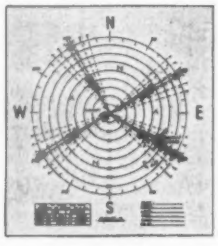
California Flyers is the only U. S. Government Approved School in Los Angeles offering *both* flying and mechanics courses, or combination courses for career men. Ask us why this is vastly important to the student wanting all-around training – or to the student of mechanics wanting practical experience under actual airport conditions. Send for our catalog to get a comprehensive picture of opportunity for you in Los Angeles and a complete description of California Flyers practical, lower-cost flying and mechanics training courses.

• • • JUST ONE OF THE MANY SUPERIOR TYPES OF EQUIPMENT AT CALIFORNIA FLYERS

The new Link Aviation Trainer, Type C, is the latest development for instruction in instrument and radio range flying. Used by the U. S. Bureau of Air Commerce for training instructors, the U. S. Army and commercial airlines and by foreign governments. It is just one of the many advantages in the most advanced equipment you get at California Flyers. It contributes to the rapid advancement of California Flyers graduates.

The Link Trainer is a mechanical device for training pilots to fly by instrument and to use the radio ranges and other modern aids to air navigation. It is electrically operated and equipped with two-way radio.

Ten standard instrument dials operate so that a movement of the controls will bring about the corresponding change in instrument readings. Instruments: magnetic compass, air speed, turn and bank, vertical speed, tachometer, marker beacon, sensitive altimeter, directional gyro, gyro horizon and radio compass.



This is the electrically recorded chart that indicates the exact course flown by the student. Every turn is indicated on the graph paper.

Instructor's desk showing radio equipment, recorder and chart. Here the instructor lays out the course the student shall follow and introduces such problems as split or bent beams, cross winds and unexpected changes in weather, requiring changes in course and almost any other problem in either navigation or cross-country flying.

SEND FOR FREE LINK TRAINER BOOK • This fascinating way of training for instrument and radio beam flying (blind flying) is fully described in California Flyers' new Bulletin. Send for your copy today.

SEND FOR THESE TWO FREE FOLDERS TODAY • Brimful of terse, interesting facts. Comprehensive folders on the things you want to know about aviation.

CALIFORNIA FLYERS, INC.
School of Aviation Dept. AD-3
Los Angeles Municipal Airport, Inglewood, California

Please mail me, without charge, your new catalog *Aviation Is Calling You* and the new Link Trainer Bulletin. I am interested in subjects checked.

Flying ☐ Mechanics ☐
Combination Courses ☐ Instrument Flying ☐

NAME_____ AGE_____

ADDRESS_____

CITY_____ STATE_____

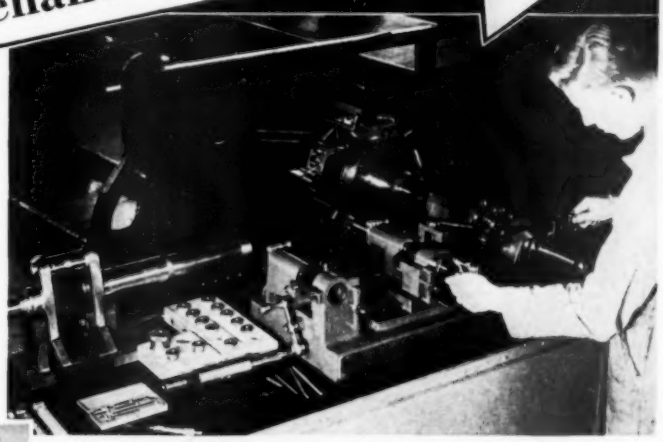
CALIFORNIA FLYERS, INC.
SCHOOL OF AVIATION
LOS ANGELES MUNICIPAL AIRPORT, INGLEWOOD, CALIFORNIA

Commercial Aviation *Approves* PARKS AIR COLLEGE Maintenance Engineering Course*

Graduates of this highly specialized training are finding their places promptly in Aviation

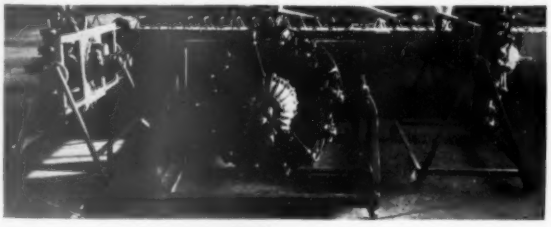
Maintenance Superintendents and Production Managers of the world's aviation centers show their approval of this training by employing graduates as rapidly as they are available. Graduates themselves demonstrate the fundamental worth of the 96 weeks' training by earning and securing satisfactory advancement in the widespread, diversified field of commercial avaiation.

**Formerly called the Master Mechanics' Flight Course.*



Above—$1,600.00 Taft-Peirce boring fixture, the most modern machine of its kind. Every Maintenance Engineer gets practical training in its operation.

Above—20 hours of flight training on low-wing Kinners, along with 3360 hours of maintenance and background training—all a part of Maintenance Engineering.



Above—Twin row Wasp 650 h. p. motor, a part of Parks training equipment—a type used on today's modern airliners.

Above—Engineering drafting in this course occupies 5 hours per week for 12 weeks.

Above— Parks Air College orchestra spotlights school social functions.

College & Professional Training

Your success is assured if you have the character and energy to make the grade. Parks offers you 8 terms (2 years) of well-balanced training, using the most extensive school equipment available—in fact, in your training at Parks you will have the use of physical assets with a value of $2,143.00 for each student entered, a sum total of $642,995.14—all devoted to training purposes exclusively. It will pay you, too, to measure carefully the value of Parks training by the substantial worth of its curricula. Records prove that with but a single exception all of the graduates of Maintenance Engineering have made good connections in aviation before graduation, at the time of, or shortly after graduation. Maintenance Engineering is your direct and sure approach to profitable endeavor in commercial aviation.

Only Parks' 96 weeks course in Maintenance Engineering offers you carefully coordinated theoretical and practical training in such subjects as:

Engineering drawing; Loft practices; Mathematics; Advanced Instruments; Physics and Chemistry; Maintenance Management; Industrial Engineering, Air Transportation History and Development; Radio Maintenance and Operation; Power Plants, Accessories, Fuels and Lubricants; Machine Shop Practice; Flight Line Maintenance; Foremanship; Design of Maintenance Equipment; Inspection; Business Writing, Talking and Salesmanship; and many other subjects. Get outline of Maintenance Engineering—also the three other major courses: Professional Flight and Executive, Aviation Operations and Executive and Aeronautical Engineering.

Open to High School Graduates. Enrollments accepted for Summer Term, July 5th.

PARKS AIR COLLEGE

EAST ST. LOUIS, ILL. **SECTION PA-5**

Send to me at once all details about your 96-week course of Maintenance Engineering, also details of the other three major courses.

Name..... Age.....

Address.....

City.....

State.....

Approved as a transport, ground and flying school and mechanics' school by the U. S. Department of Commerce, also accredited by the Illinois Superintendent of Public Instruction.

Publishers of
POPULAR AVIATION
POPULAR PHOTOGRAPHY
RADIO NEWS

Now on Sale
AT ALL NEWSSTANDS!

When Day is Done . . . At the end of a hard day's work or study you need RELAXATION. Business leaders, presidents, statesmen turn to FICTION . . . detective stories, love stories, adventure stories. But men of science, men of technical background turn to **AMAZING STORIES**

Ably edited by technical men, **AMAZING STORIES** offers the BEST in Science-Fiction, Astronomy, Physics, Chemistry carefully woven into exciting, diverting STORIES that will carry you off into new and unexplored worlds of science

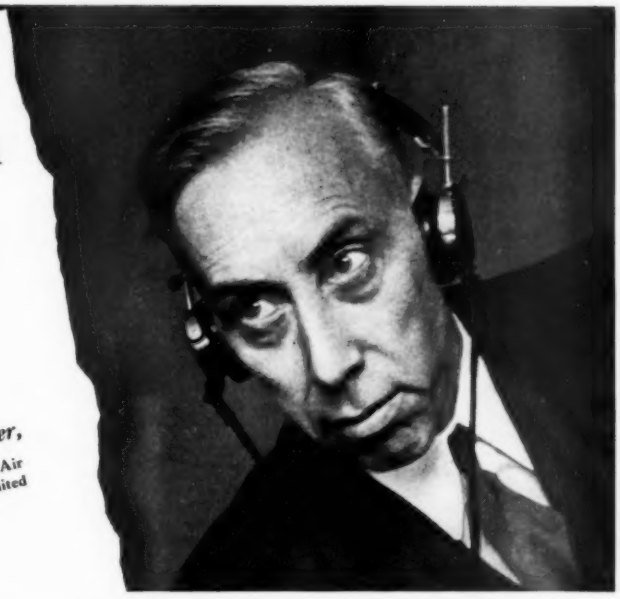
EVERY STORY SCIENTIFICALLY ACCURATE

POPULAR AVIATION, Volume 22, May, 1938. Published monthly by Ziff-Davis Publishing Company, at 608 S. Dearborn St., Chicago, Ill., U. S. A. Subscription $2.50 per year, single copies 25 cents, foreign postage $1.00 per year extra, except Canada. Entered as second class matter, January 24, 1933, at the Post Office, Chicago, Illinois, under the act of March 3, 1879.

"Boeing School prepares a man for more than the first job in aviation"

—says R. W. Schroeder,

former Chief Air Lines Inspector of U. S. Air Commerce Bureau—now Vice-President, United Air Lines, in Charge of Operations



Records of its graduates prove that Boeing School of Aeronautics trains men to climb up ***in today's fast-growing aviation industry . . . fits them for*** careers

THE REASONS why alert young men train with Boeing are inherent in the character and background of this famous school.

Boeing School was founded, not by outsiders, but by a part of the industry itself—by United Air Lines, world's most experienced air transport organization. It grew out of aviation's pressing need for trained recruits . . . career men.

And today, as always, United supervises every detail. Boeing School, in fact, is a division of United Air Lines.

Boeing School shops, laboratories, lecture rooms, and the flight house stand at the very edge of A-1-A Oakland Airport. At this main United West Coast terminus you see pilots, operations men, engineers—all with years of practical experience—working at the very jobs you are studying.

In this school each instructor has an average of only 8 students. You get the fullest measure of thorough, personal instruction.

Boeing School can best train you for a career in aviation *because this school is part of the industry!* Twenty-seven aviation companies now employ 953 Boeing graduates.

• • •

Learn more about being a *career man* in aviation. Send for *free* 1938 BOEING SCHOOL BULLETIN. It describes the school and the 15 Pilot, Ground and Engineering career courses offered. Contains full vocational guide to all fields of aviation. Use coupon below.

Boeing School of Aeronautics
GRADUATION and PLACEMENT RECORD
(February 1937 — January 1938)

Months	Number Graduated	Number Placements	No. Co.'s Employing Graduates
1937			
Feb.	4	13	7
Mar.	33	21	11
Apr.	8	16	6
May	1	16	6
June	34	14	8
July	5	7	2
Aug.	4	2	2
Sept.	20	17	7
Oct.	4	3	2
Nov.	2	2	2
Dec.	29	7	3
1938			
Jan.	7	14	6
TOTAL	151	132	27

Students in "Airline Mechanics" completely overhaul flying engines in the Boeing School Power Plants Shop

Boeing School of Aeronautics

A division of UNITED AIR LINES

U. S. Government approved in ALL departments—Private and Commercial Flying, Mechanic Training, and Repair Station

A COMPLETE RANGE OF 15 CAREER COURSES

There's one specially designed to provide a thorough foundation for success in *your* chosen field of aviation

Check the course or courses you're most interested in:

Courses requiring high school only:
- ☐ Airline Pilot and Operations
- ☐ Commercial *(or)* L. C. Pilot
- ☐ Private *(or)* Solo Pilot
- ☐ Airline Operations
- ☐ Airline Mechanic
- ☐ Aircraft Sheet Metal

Courses requiring 2 yrs. pre-eng.:
- ☐ Air Transport Engineering
- ☐ Practical Aeronautical Engineering
- ☐ Airline Flight Officer

Courses for engineering graduates only:
- ☐ Airline Technician
- ☐ Dispatching and Meteorology

Courses requiring special training:
- ☐ Special Airline Pilot
- ☐ Instrument Rating

NOTE: Link Trainer Instruction available to students in all courses.

Boeing School of Aeronautics,
Dept. Q-28, Airport,
Oakland, California.

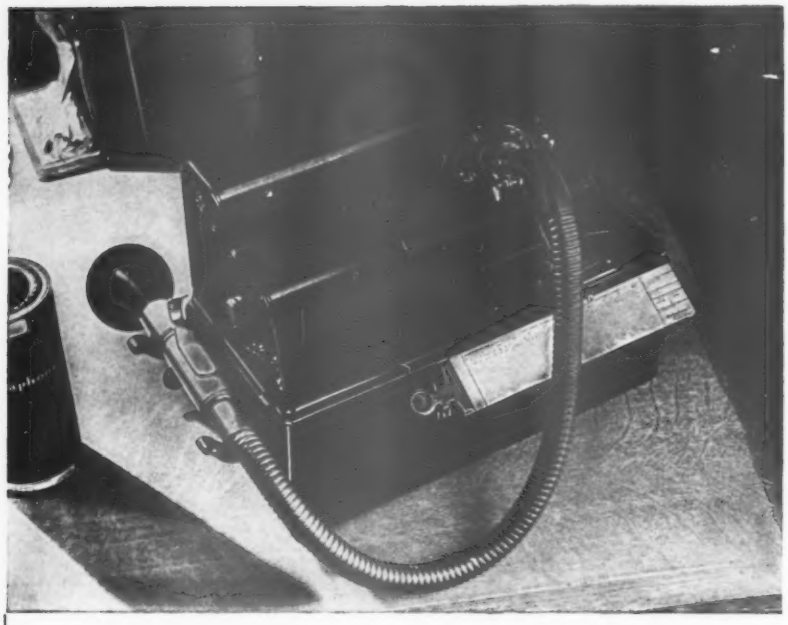
GENTLEMEN: Please mail me—without charge—the 1938 BOEING SCHOOL BULLETIN containing complete information on the school and courses I have checked at the left.

Name _____

Address _____

City _____

State _____ *Age* _____



IN YOUR BUSINESS TOO—

THE TREND TO DICTAPHONE SWEEPS ON

Never has interest in Dictaphone run so high as it does today. Businesses of every sort and size are turning to this modern dictating instrument—simply because it gets things done so quickly, smoothly, accurately and conveniently.

Actual handling of correspondence is only the first of a long list of Dictaphone's benefits. All day long, it lets men and their secretaries work, independent of each other's time and convenience. Try out Dictaphone in your office.

A working demonstration costs you nothing. Just ask the Dictaphone office nearest you to call on you. Meanwhile, send for a mighty interesting booklet without cost—"What is An Office Anyway?"

Some Important Benefits of Dictaphone:

You and your secretary do a day's work apiece, independent of each other's convenience. You double your capacity to get things done—record telephone instructions beyond question or slip . . . pin down valuable ideas the instant they occur . . . make instructions clear and alibi-proof.

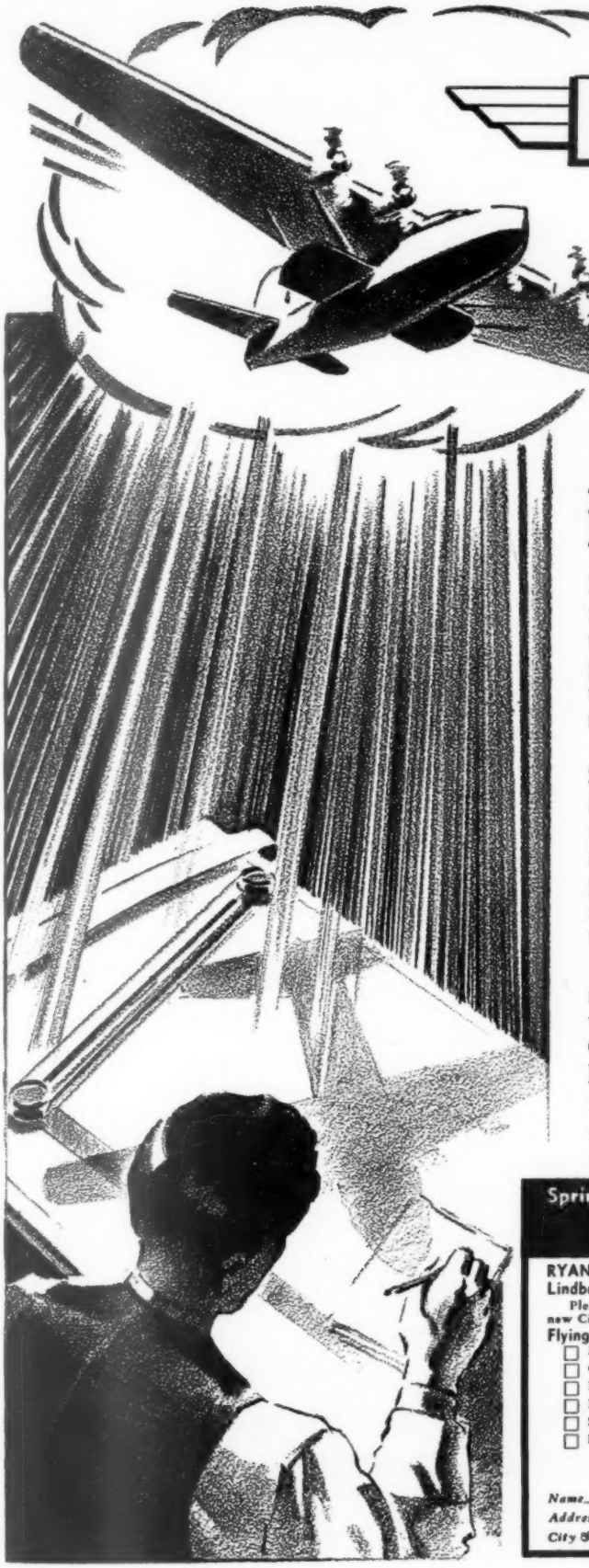
Ask to see the NEW PROGRESS CABINET ➔

DICTAPHONE

The word DICTAPHONE is the Registered Trade-Mark of Dictaphone Corporation, Makers of Dictating Machines and Accessories to which said Trade-Mark is Applied.

DICTAPHONE SALES CORPORATION

420 Lexington Avenue • New York City



RYAN

Now Trains you in

AERONAUTICAL ENGINEERING

INDUSTRY DEMANDS more men properly trained for aeronautical engineering. Young men, alert to this opportunity, can now train under the personal supervision of T. Claude Ryan, one of the foremost manufacturers, whose airplanes make history.

Affiliated with the factory producing Ryan S-T and S-C airplanes and with 15 years success in training men for aviation, the Ryan School now offers one and two-year courses in aeronautical engineering, balancing theory with practice under actual factory conditions. The *most practical*, if not the ONLY courses of their kind in America!

Learn engineering where the U. S. Navy maintains its largest flying base, scene of the world's greatest flying activity; where the huge Consolidated Aircraft plant is right next door. Enrollment applications now accepted; high school education or equivalent necessary. Get catalog describing courses in accordance with revised Air Commerce regulations.

Spring Term Begins April 4. Insure Reservations by wiring "collect" Western Union or Postal Telegraph that you will be here.

RYAN SCHOOL OF AERONAUTICS
Lindbergh Field, San Diego, Calif. Dept. PA-5

Please send information on courses checked with revisions in conformity with new Civil Air Regulations.

Flying Courses

- ☐ Master Pilot
- ☐ Commercial (formerly transport)
- ☐ Limited Commercial
- ☐ Private
- ☐ Solo (formerly Amateur)
- ☐ Deluxe Combination—includes a new Ryan S-T-A plane with complete commercial course.

Ground Courses

- ☐ Aeronautical Engineering
- ☐ Airplane Drafting & Design
- ☐ Master Mechanic
- ☐ Master Mechanic and Flying
- ☐ Aircraft Welding
- ☐ Advanced Navigation
- ☐ Master Radio

*Name*_____ *Age*_____

*Address*_____

*City & State*_____

Dallas Aviation School and Air College

Major W. F. Long, Pres. **At Love Field, Dallas, Texas** *C. E. Harman, Sec'y-Treas.*

THERE IS MONEY IN THE SKY Let Us Help You Get It

Save $1,000.00 or more on your Course

and get more flying time in less time. At the average school it takes from one to two years to get a

Transport Pilot's License

because of weather conditions and other controlling factors. Here it is a "natural." Weather and all things are equal and you can fly practically every day and pile up your hours to your heart's content. You will save your money and time and be one of the "better pilots."

16 Fine Ships Now!

Another Wasp Stearman just added: Also "Wasp Laird" (sky writer). Biggest and best array of fine ships owned by any school.

Here they are:

2 Wasp Stearmans
2 Wright Stearmans
6 Fleets
1 Bellanca
1 Stinson
1 Aristocrat
2 Wacos

and our students fly them

[Also the famous "Link Trainer"]

1700 Student Flying Hours First 3 Months This Year

WHY PAY MORE?

Flying Courses:

MASTER AIRMAN $2,805.00
311 air hours; 46 weeks

TRANSPORT PILOT $1,855.00
205 air hours; 20 weeks

Limited Commercial Pilot $735.00
60 air hours; 12 weeks

PRIVATE PILOT $640.00
50 air hours; 10 weeks

Mechanical Courses:

ADVANCED AVIATION $570.00
44 weeks

MASTER MECHANIC $330.00
24 weeks

AIRCRAFT INSTRUMENTS $355.00
24 weeks

AIRCRAFT RADIO $380.00
24 weeks

METAL AND WOOD-WORKING $430.00
24 weeks

For All Students:

Part time work if desired.
Travel allowance.
Cash Discount.
Board and Room at the School.
$10,000 in new improvement already this year.
We are ready for you.

And The Level Plains Of Texas To Fly Over

WRITE FOR SPECIAL OFFER

Our "Round-Up" is now on for Spring enrollment and our special offer is very attractive from every viewpoint. We have the things you need in flight and mechanical training at a cost that is more than reasonable. Our school leads in comparison.

MAIL THIS COUPON

Dallas Aviation School,
Dallas, Texas

Please send your 1938 catalog to:

Name.....

Address.....

City.....

State.....

I am interested in taking a course in:

☐ Flying ☐ Mechanics

Age.....

LOVE FIELD — Dallas Aviation School and Air College — DALLAS, TEXAS

Where You Get The Most of The Best . . . *Why Pay More?*

POPULAR AVIATION

Including SOUTHERN AVIATION and AERONAUTICS

Volume XXII | MAY, 1938 | Number 5

FOR THE PROMOTION OF PRIVATE FLYING AND COMMERCIAL AVIATION

CONTENTS

FEATURE ARTICLES

Billy Mitchell Warned Us! ... 12
Trans-Atlantic Wings ... 14
Guiding Sparks ... 18
Sky Lights ... 21
Suicide Crew ... 22
Mailman Overboard ... 25
The Man Under the Hood ... 26
Flying Home on Sealskin ... 27
Alone Across America—Blind! ... 28
Cadet Days at Kelly Field ... 31
Personalities ... 34
The Yanks in Spain ... 37
The Story of De Havilland ... 38
Flying Cops ... 44
The National Air Board Says ... 48
Soaring Flight of Sea Birds ... 49
A Letter From Fred Noonan ... 51
A "Tricycle" Forced Landing ... 53
How's the Weather? ... 54
Camera Mapping ... 57
Give the Old Boys a Chance ... 60
How to Rig a Light Biplane ... 63
Building the Curtiss P-37 Model ... 64

Copyright, 1938
ZIFF-DAVIS PUBLISHING COMPANY
Member of the Audit Bureau of Circulations.

POPULAR AVIATION is published monthly by the Ziff-Davis Publishing Company at 608 S. Dearborn St., Chicago, Ill. William B. Ziff, Publisher; B. G. Davis, Editor; John B. Rathbun, Managing Editor; Max Karant, Associate Editor; Swanee Taylor, Advertising Manager. Herman R. Bollin, Art Director. New York Office, 381 Fourth Ave. Subscription $2.50 per year; single copies, 25 cents; foreign postage $1.00 per year additional, except Canada. Contributors should retain a copy of contributions. All submitted material must contain return postage. Contributions will be handled with reasonable care, but this magazine assumes no responsibility for its safety. Accepted material is subject to whatever revisions necessary to meet requirements. Payment will be made at our current rates upon acceptance and, unless otherwise specified by the contributor, all photographs and drawings will be considered as constituting a part of the manuscript in making payment.

An Airy Chat with the Editor

IT is fine to witness the fighting spirit of our amateur pilots and builders who, attacked viciously on all fronts, have dug themselves in and have prepared for the long struggle with obstructive legislation.

Several hundred coupons, clipped from POPULAR AVIATION have already been sent in and, as several of our correspondents have resolved themselves into membership committees, we expect to receive many more of these slips. Next issue we will be prepared to tell you how many votes we have received and just what we are intending to do with these names.

* * *

JUST after we had formulated this voting scheme for the lightplane amateurs, the idea came into our heads that it might be a good idea if we would attempt to kill two birds with one stone and include the gas model builders in our protest. In short, while we are about it, also make a protest against the restrictions and prohibitions that are being leveled against the miniature divisions at one and the same time with our lightplane activities.

And so, if you gas model fans wish to step into the fray with the lightplaners, just signify in the usual way by sending in your ticket. If you belong to a gas model club, then it should be a simple matter to roll up an astoundingly large vote against gas model prohibitions. Do it now while it is on your mind.

* * *

WHILE we are watching the establishment of scheduled flying service on the North Atlantic, we are likely to overlook the transatlantic service across the South Atlantic which has been in operation for several years. The old idea that conditions across the North Atlantic are more difficult than the Southern route is scorned by those men who have intimate contact with the transatlantic service to South America, who claim that there are just as many serious problems, though not necessarily the same problems, as there are in the North.

* * *

WHILE on the subject of the South Atlantic, we cannot resist the

(*Concluded on page 72*)

Billy

Mitchell WARNED US!

By MAJOR-GENERAL JAMES E. FECHET

General William "Billy" Mitchell

Major-General Fechet, in his second of a series of articles, scores a few telling points in that age-old battle between the Army and Navy. Taking up where Mitchell left off.

Major-General Fechet

GENERAL WILLIAM MITCHELL told us as long ago as 1920 that the Navy planned to take over the defense of the United States, relegating the Army to a trifling handful of skeletonized units, a pitiful home guard. She would do this, he said, by seizing the purse strings.

The Army's appropriations would be reduced year by year and those of the Navy would grow year by year. The junior service each succeeding year would appropriate more and more of the functions of national defense which had previously been well understood as duties and responsibilities of the Army.

Eventually, he taught, by a skillful use of her vast and well-organized public relations machine and by her political influence she would hog the whole show. The Army under her scheme would look like the child who had been chained to a chair in the garret for years, it would be misshapen, ill nourished, starved, dwarfed; it would have rickets.

That was the picture the Stormy Petrel painted of the ambitions and desires of the water member in the two-man team of national defense in this country. Like many a prophet he did not live to see his prophecy come true in its entirety. I think, however, even he would be shocked were he alive today to hear that the grave international situation is such that our national defenses must be strengthened by eight hundred fifteen million dollars of extra appropriations—eight hundred million for the Navy and fifteen million for the Army.

Eight hundred to 15: There you have naval opinion apparently as to the relative effectiveness and value of the two services in the defense of the Nation!

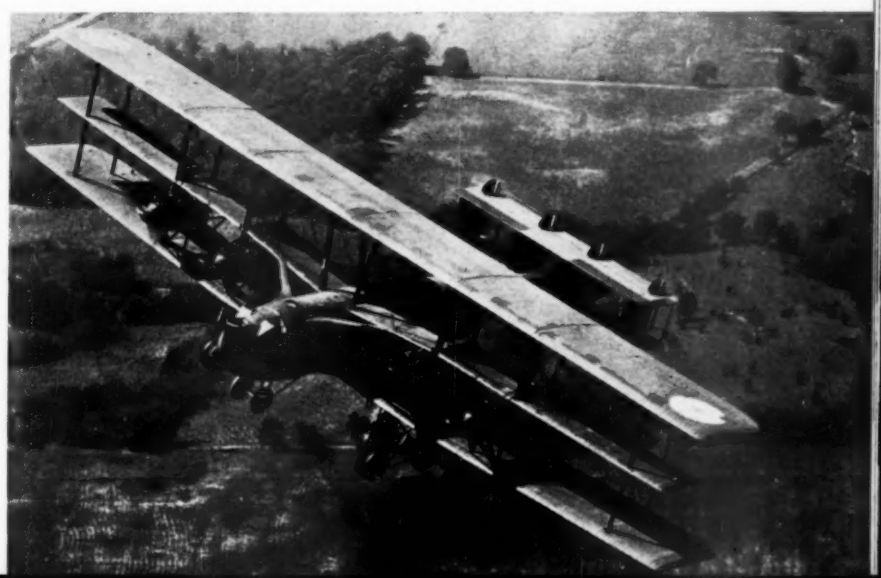
It would seem that our self-styled "first line of defense" is to be made so strong that we shall not need a second line of defense. It appears that our coach is going to have such a powerful forward wall for our team that we can hope to win ball games without a backfield.

This Mitchell prediction of a naval raid on the treasury was not the only crystal gazing done by the Army's "Bad Boy" nearly 20 years ago which has come to pass in recent times.

He shouted to the multitude two decades ago: "It is no longer enough for any nation to be mistress of the seas; to be secure, she must be mistress of the skies. England does not realize that now but she will discover it to her sorrow and embarrassment."

Events, 15 years later, made these words look more like revelation than prophecy. Italy began to move into Ethiopia. England disapproved. First she threatened, then she started the parade of her fleet into the Mediterranean, an old trick which had worked so well so often. The mistress of the seas had for generations a magic wand which she could wave at any peace table. She could arrange a parade of her proud fleet past the window where the diplomats sat at counsel at the psychological moment and she could be sure that things would be decided her way.

So, when Mr. Mussolini proved recalcitrant, England decided to give him the old medicine: she steamed up with the



The lumbering old Barling bomber was dubbed "Mitchell's Folly" years ago.

water wagons and rowed them down past Gibraltar on a leisurely cruise toward Malta and the Eastern end of the Mediterranean, with serene confidence that soon all would be well, truant Italy would be properly impressed.

But Mussolini had a counter trick. He paraded too. He ordered out his submarines, light torpedo sleds and bombing planes to pass in review. What was the result of these competing parades on the same street on the same afternoon?

England decided instantly that the cruising was much better in the Western end of the Mediterranean. The water seemed much smoother up Alexandria way.

Try this experiment. Take the range of an Italian bombing plane as the length of a piece of string; put one end of this string down on a map at a point indicating the westernmost Italian airdrome; with that string as a radius, strike off an arc across the Mediterrannean. Now you will know where the British fleet went—just outside that circle.

The people of England were shocked out of their well known reserve and complacence. Never before had anyone failed to respond to the water cure. As soon as the shock was over and John Bull had time to think the whole thing through, he arrived at Mitchell's answer —England must be mistress of the air. Thereupon England started the greatest airplane building program the world has ever seen.

By the admission of her own experts she is now building 700 planes a month. In the course of a very few months she will have an air armada which will make her the favored mistress, again restore her as the belle of the international ball. In reading this latest lesson from history don't forget that ringing prophecy delivered in the Mitchellesque manner years ago:

"It is no longer enough to be mistress of the seas; any nation which would be secure must now be mistress of the skies."

Here is another Mitchell-ism which at the time it was issued sounded to some like the ravings of a madman. The flying general said our best airplanes of today —the days were in 1922 or '23—are but the toys and playthings of children. "We must have bombing planes capable of carrying two or three two thousand pound bombs; we must have bombers which can reach any enemy capital and return home again without landing; we must have fighters which can carry cannon!", he cried.

Somewhere there sits today an old crate: it is hoary and ratty but very large; it is the wasted wreck of an old plane. It was Mitchell's effort in the early 1920's to build a giant bomber. It was styled Mitchell's Folly. It had six engines and was a giant of a plane.

Officially, it was called the Barling bomber. It was an over-sized animated bird cage; but not very animated. It was unwieldy and heavy, with its six smoking wheezing engines of that day it was

(*Concluded on page 72*)

Two Lucky Marines

by Harold Keen

A PAIR of skylarking Marines stared death in the face some weeks ago, grinned right back, and blithely sideslipped the specter in an experience defying parallel in aviation annals.

Chief candidates for the "Borrowed Time Club" today are First Lieutenant Guy M. Morrow and Corp. Milton M. Frankel, whose "phantom plane" adventure has been classed by the Navy and Marine Corps as one of the freakiest in history.

This is the story of two courageous airmen's near-fatal rendezvous with death, as just revealed by the Marine Corps:

Three trim, stub-nosed planes of Marine Scouting Squadron Two took off from their base at North Island, San Diego harbor, last Armistice Day. At the controls of plane 2-MS-3 was Lieu-

Lieut. Guy M. Morrow, USMC, is a life member of the Borrowed Timers.

tenant Morrow, accompanied by his mechanic, Corporal Frankel.

After maneuvering in gunnery practice over the Pacific, the squadron headed inland for the deserted area at Kearney Mesa, where the Navy operates an emergency landing field. By this decision to complete the drill overland, the life of Corporal Frankel probably was saved.

Suddenly, Fleet Marine Force aircraft headquarters at North Island were electrified by the following radio message which crackled through from Plane 2-MS-3:

"Have shot off target sleeve, which is caught on our right wing."

One of the rarest of occurrences had happened. Shots from Lieutenant Morrow's plane had severed the cable attaching the full-blown target sleeve to one of the other ships.

To aggravate the situation, the controls of Plane 2-MS-3 were jammed because of the paralyzing effect of the heavy sleeve wrapped around the wing. Lieutenant Morrow advanced to full throttle and exerted his last ounce of pressure with both feet on the left rudder to keep the plane under control. He informed headquarters he did not believe it possible to land without cracking up.

Corporal Frankel, in the rear cockpit, thought fast. Since the sleeve's nose ring had firmly attached itself in a perfect "U" about the upper right wing's leading edge, there were only two alternatives: bail out or cut away the sleeve. He asked Lieutenant Morrow's permission to do the latter. It was a daring, desperate chance, but he was willing to take it. Lieutenant Morrow hesitantly gave permission.

Frankel climbed out of the cockpit, slowly edged his way along the lower wing. Halfway out, with the wind blast threatening to catapult him into space and his grip extremely shaky, Corporal Frankel glanced at Lieutenant Morrow. The latter saw it was hopeless to continue the brave attempt, motioned his mechanic to jump. And jump he did, over the trailing edge of the lower wing.

Once clear of the plane, he opened his parachute and drifted earthward. The abrupt landing knocked him momentarily unconscious, but he awakened to find himself unhurt and newest recruit of the Caterpillar Club.

Had all this occurred over the ocean, where the planes were maneuvering only a short time before, Corporal Frankel probably would have drowned on landing.

Meanwhile, Lieutenant Morrow was experiencing terror-filled moments. Once Frankel had jumped, the pilot began his fight for life. He decided to abandon the plane. He would leave his cockpit from the left, he planned, as soon as he could free himself after releasing the controls. He let go and started to climb out. Panic swept through him when he realized that his parachute pack had fouled on the left rear cabane strut, to which he was literally pinned by the terrific pressure of the wind.

All this time, the plane, now totally out of control, was diving in a steep spiral. It was curtains for Lieutenant Morrow, who realized, with the craft less than 1,000 feet from the ground, that he could not clear it in time for a parachute landing. It was curtains—unless he took a million-to-one chance to bring the plane, roaring with a crescendo of death toward the earth, out of its dive. He reached into the cockpit. Mustering the strength in every fiber of his body, he grabbed the stick, pulled it back. He knew he was only seconds from eternity. Miraculously, the plane recovered from its dive, regained a normal position, zoomed upward and away from the rocky ground. Ashen-faced, Lieutenant Morrow climbed back into the cockpit,

(*Concluded on page* 91)

OUTWARD BOUND

Brilliant flags on *China Clipper's* nose and wing help protect her from prowling Japanese warplanes in China.

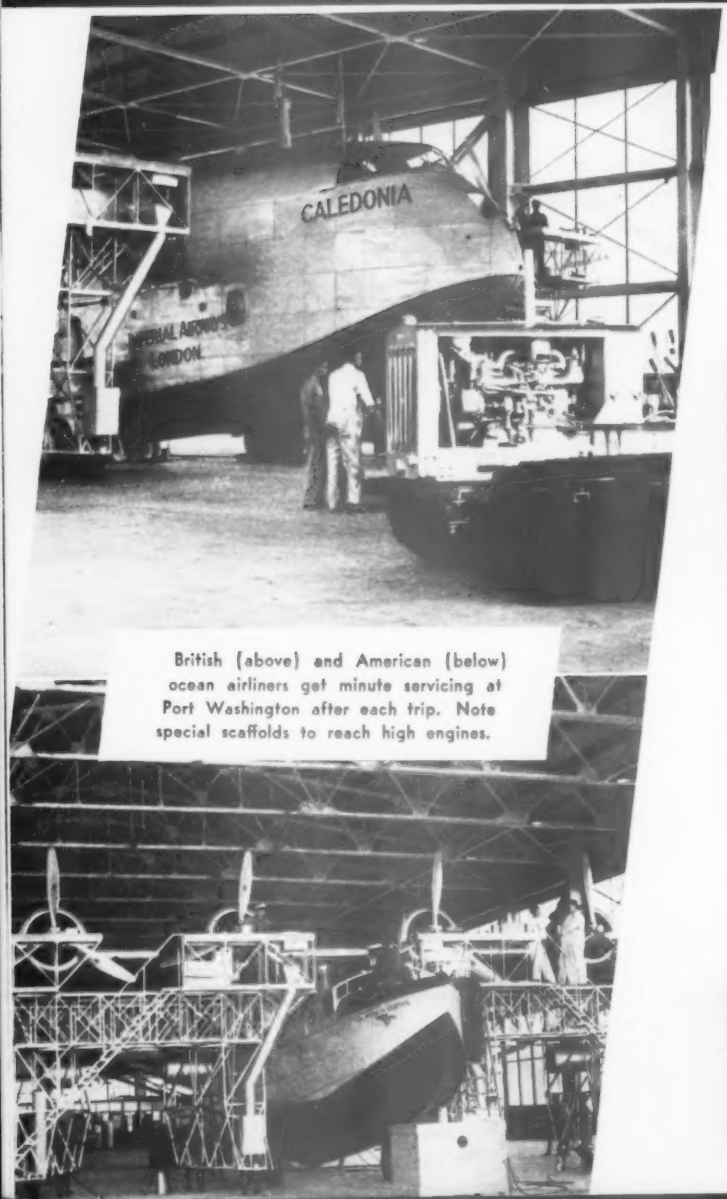
TRANS-ATLANTIC

CONQUEST of the North Atlantic by air transportation, the great goal toward which air transport leaders have been shaping their activities since the trail-blazing Lindbergh flight more than 10 years ago, is expected to provide one of the great dramas of 1938, with at least four great nations making bids for the spotlight.

The curtain is expected to go up in May or early June, according to the latest information available in Washington, where emissaries of competitor European powers have been in consultation with Federal diplomatic and aeronautical officials during the past two years.

With a schedule of pioneering flights safely behind them, Pan American Airways and British Imperial Airways are

(*Continued on page* 16)



British (above) and American (below) ocean airliners get minute servicing at Port Washington after each trip. Note special scaffolds to reach high engines.

Pan American's base at Port Washington is the trans-Atlantic lines' headquarters.

One of the most important jobs in trans-ocean flying is that of the weatherman. Navigation officers (right) chart courses in flight based on data supplied them by airline meteorologists.

WINGS

by JOSEPH EDGERTON

The U. S., England, France and Germany all have their bid in on the aerial trade routes over the Atlantic. Current experiments promise ocean air travel soon.

Imperial Airways, with the Americans, have pioneered the North Atlantic route. "Empire" boats (above) made some of the first flights.

Three nations' flags are flying from the mast at the Port Washington base. The uppermost flag tells of the pending departure of one of the ocean-spanning planes. Temporary base now is at Baltimore.

Germany's catapult airliner presents a sharp contrast to Pan American's Sikorsky (above). The Germans are flying the southern routes.

expected, perhaps as early as May, to extend their joint United States-Bermuda service on across the Atlantic in a dramatic bid for a share of the rich traffic which for centuries has been the cause of stirring international maritime rivalry. Delivery of giant new flying boats, notably the great 43-ton Boeing 314 *Atlantic Clipper* holds the key to the opening of actual service.

Regarded as the first real trans-oceanic airliner, the "314", powered by four 1,500 horsepower engines, will provide features of comfort and safety never before attained even in the older over-land services. Test flying of the first of these giants is expected to begin in April, according to Pan Am.

The British, too, are busy. Imperial expects to have a fleet of flying boats weighing 35 long tons, or 78,400 pounds gross, ready this year for the Atlantic service. And it is rumored, though definite reports are still lacking, that British designers are at work on flying boats of around 150,000 pounds gross for the trans-Atlantic service.

Germany and France are very much in the running in the North Atlantic field. The Nazis expect next May to resume Zeppelin service between Friedrichshafen and Lakehurst, N. J., with the LZ-130, successor to the *Hindenburg*. The new airship will be inflated with American helium, now being shipped under administration sanction.

The German Reich, however, has other ambitions than airship service. Last year Nazi envoys obtained from the State Department permission to conduct experimental flights across the Atlantic. With new four-engined type catapult mail planes, the *Nordmeer* and the *Nordwind*, the Germans conducted seven round-trip exploratory flights between the Azores and Port Washington, L. I. The German permit still is in effect and further flights are on the calendar for this Summer.

France also obtained permission to undertake exploratory flights to the United States and Air France, early this year, is expected to begin a survey flight program. Both Germany and France are active in the designing of flying boats of ocean-going caliber. Of the German designs there is only meager information. Air France Transatlantique, however, according to sketchy reports via the ocean cables, is about to place—may by now already have placed—orders for a fleet of 72-long-ton (161,280-pound) flying boats with which to get into the transport race. It also is reported that Air France Transatlantique has budgeted some $5,000,000 for preparatory work alone, including establishment of bases, installation of radio and weather equipment, research stations, survey operations and personnel training.

On the whole, this is a most ambitious sort of international program. And don't think that the maritime interests lack an appreciation of the seriousness of the threat of air competition; The United States Maritime Commission has sent to Congress a report detailing ocean air transport progress and prospects and has recommended that legislation be enacted placing responsibility for development of this new form of overseas transport in the hands of the Commission.

"The swift advance and the increasingly impressive performance of trans-oceanic aviation makes it evident that it soon will become a tremendously important factor in our foreign commerce," commented Chairman Joseph B. Kennedy, recently appointed Ambassador to Great Britain.

The Maritime Commission explained to Congress that American aircraft manufacturers now have designs for flying boats weighing 120,000 pounds, having an average speed of 175 m.p.h. and a non-stop range of 5,000 miles. Such aircraft would be capable of carrying 40 to 50 passengers from New York to Europe in 20 hours, the Commission said.

"The conclusion is apparent," said the Commission, "that aircraft soon will be a serious competitor in the overseas fast express and passenger trade which is now being largely served by the super-liner, with the distinct possibility that aircraft eventually will displace the super-liner."

The Commission found that a fleet of 18 flying boats, on a daily service of three planes a day, would offer the same total passenger capacity a year as a super-liner, at a production cost of $18,000,000 for the planes, as against $50,000,000 for the liner.

The Commission proposed that steamship lines, for their own protection, might well go into the question of operating flying boats themselves. The suggestion met with immediate response. W. H. Coverdale, president of the Export Steamship Corp., petitioned Congress to clarify the law to permit competition in transoceanic air transport; announced that if the "monopoly" were broken, his company stood ready to invest $25,000,000 in new equipment, part of it for flying boats. He sketched plans for twice-a-week flying service, non-stop to Lisbon and on to Marseilles, Rome, Athens and Alexandria. Captains of the company's vessels plying the North Atlantic are being instructed by Dr. James H. Kimball, foremost trans-Atlantic weather authority, in the technique of special weather observations to facilitate overseas flying.

It has become apparent on both sides of the Atlantic that the new ocean flying boat has become an instrument in a new economic warfare and the chancelleries of the world powers and the financial marts of America, Europe and Asia have entered into a rivalry the goal of which is eventual supremacy of the air. Their aim is to reap profits in the form of prestige, trade and national security.

Thanks to the foresightedness and aggressive policies of this country's "empire airline", Pan American Airways, the United States today has attained a position of leadership on the ocean air trade routes which it lost on the sea routes with the passage of the wooden clippers of another day.

But this country's primary advantage is threatened sharply. Great Britain, in her traditional role, is protecting her routes of empire by pouring millions of pounds into the development of commercial aircraft and new air routes. She aims at domination of air routes to Africa, the Orient and North and South America. For the purpose she has set aside a subsidy said to total $150,000,000.

The German subsidy is said to total $40,000,000, a generous slice of which is ear-marked for Lufthansa to be used in sending seaplanes to the United States by way of Lisbon and the Azores.

The French subsidy of $25,000,000 will help Air France to build 18 of the giant flying boats now on order, 12 for the South Atlantic and six for the North Atlantic.

And how about the United States? There is, of course, no subsidy as such in sight to aid in the conquest of the North Atlantic. There are no airmail contracts available yet and Pan American so far is very much on its own. It has, nevertheless, a mighty advantage. Several years ago far-seeing Juan Terry Trippe began quietly to corral operations, concessions and privileges looking to the day which is about to dawn. The international concessions which he engineered are today a powerful weapon in his hand.

They justify Pan American in going ahead with plans which, without this protection, might well have been impossible. It was not all clear sailing, however. Great Britain was not blind to what was going on and demanded of Pan American as much as she gave. The result was establishment of the joint operations agreement under which Pan Am and British Imperial last year inaugurated service to Bermuda and pioneered the North Atlantic. This rule of joint operation will prevail in the late Spring when, it is anticipated, the pioneering of the routes between the United States and England on schedule will begin.

The Atlantic saga actually began May 25 last when a Sikorsky Clipper charted the first flying course to Bermuda, 773 miles southeast of New York. On the same day, under the joint operations policy, the British *Cavalier* made the first flight from Bermuda to Port Washington. A few more preliminary trips and regular schedules were undertaken, soon to be increased to four round trips a week, two by each line.

On July 3, with a calm precision born of years of overseas operations in the Caribbean and Pacific, a Sikorsky S-42B took off from Port Washington, L. I., bound for Newfoundland and Foynes, Ireland, and Southhampton, England. In August the southern route, via Bermuda and the Azores, Portugal and Marseilles to Southampton.

British Imperial, lacking the broad experience of Pan Am in ocean flying, made five round trip survey flights across the Northern route to three American trips across. The Germans, as has been pointed out, made seven round trips.

(*Continued on page* 80)

Miss Martinez checks with the airport.

An airline car stops at her hotel.

She gets instructions.

AIR Hostess

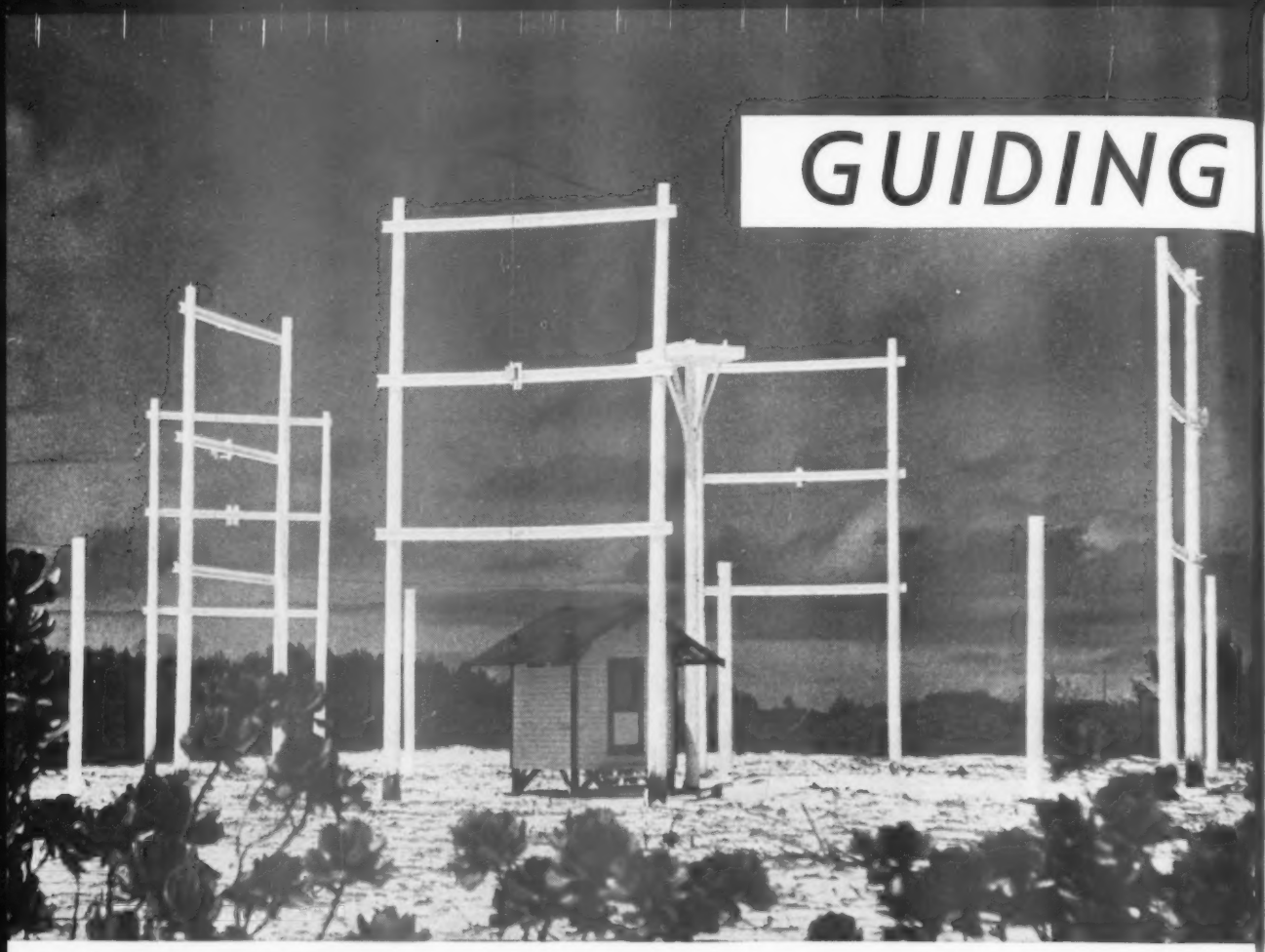
MISS IRENE MARTINEZ is one of 387 airline stewardesses that were flying the nation's airlines as this was being written. With one exception, Miss Martinez lives like, and earns as much as, the average airline stewardess (or hostess as her employers and one other U. S. airline have named these girls). Average salary is $135 per month; minimum is $125. The girls fly on an average of 85 hours per month, are allowed a maximum of 115 hours. The exception in Miss Martinez' and other Braniff Airways hostess' cases is that their company does not require its girls to be registered nurses, insists instead that they speak Spanish as well as English. But Miss Martinez and her 386 sisters live very much alike. Very few are married. Very few admit they are on the lookout for a husband. Yet the annual marriage rate among these girls is extremely high.

A brisk ride next morning.

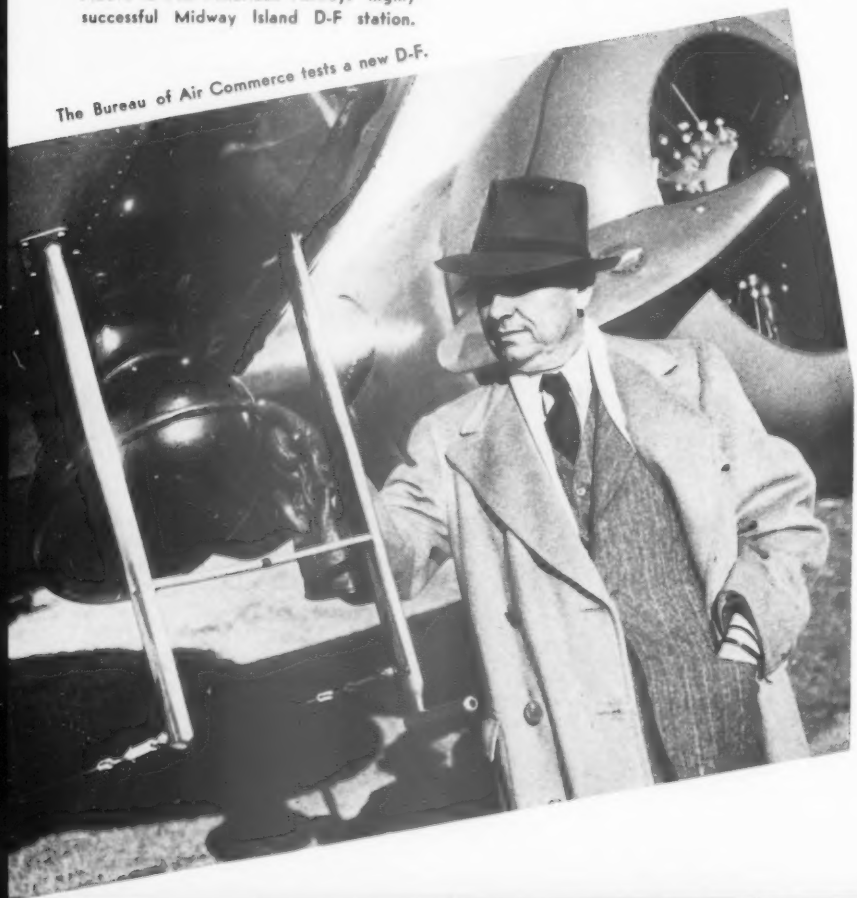
To a dance that evening.

Trip over, she dines with other hostesses.

GUIDING



Above is Pan American Airways' highly successful Midway Island D-F station.



The Bureau of Air Commerce tests a new D-F.

by W. M. WOOD

One thing that will help make aviation the safest mode of travel is the radio direction finder. Monumental advances have been and are being made.

THE principle of D-F (direction-finder) is as old as nature. Yet D-F just now is one of the liveliest and "newsiest" subjects in aviation.

The homing pigeon has had some sort of a direction-finder for thousands of years. Perhaps a pigeon's direction-finder works on the same principle as modern airplane direction-finders. The fact that the pigeon's sense of direction is seriously disturbed by radio waves gives some reason to think so.

Man's knowledge of radio direction finding dates back to the beginning of radio itself. Ships at sea have used direction-finders for many years, and during the war crude attempts were made to rig up loop antennas between the wings of airplanes to serve as homing devices.

Pan American Airways has long used ground type direction-finders, which "fix" an airplane's position by determining the direction from which a signal

SPARKS

United Air Lines conducts extensive experiments with new radio apparatus.

broadcast by the plane comes. Airplane direction-finders, used to determine the direction from which ground-broadcast signals come, have gained the attention of the aviation world only recently, and have provoked a hubbub of controversy as to their value and place in modern aviation.

A good many Europeans have been experimenting for a long time with airplane direction-finders. Several years ago Gerard Kreusi patented a homing device in this country. The Department of Commerce experimented with it. Other manufacturers soon followed Kreusi. The Army tried them out. The Coast Guard has been particularly active in carrying on experiments.

Various airlines tried out a few direction-finders some time ago, and some of them decided that the equipment then available was virtually worthless under bad weather conditions, when the radio beam might fail to come through and make the direction-finder of all times needed most. But TWA was one airline which kept on trying. Several months ago the electrostatically shielded loop was developed. This did much to overcome the rain and snow static which in bad weather may blank out radio signals on other types of antennas. And it was also a big step forward in direction finding. About a year ago TWA held its first public demonstration of its new and improved direction-finder with the shielded loop.

Then about the same time a peculiar set of circumstances brought the direction-finder into the limelight. A series of airline accidents, including the one in May, 1935, in which Senator Bronson Cutting was killed, had started an investigation of airline safety by the Senate. During 1936 a continuous controversy raged as to whether the airlines or the Bureau of Air Commerce was most to blame.

This critical examination of airline safety was approaching a climax early last winter when Dick Merrill, flying an Eastern Air Lines plane from Miami to Newark, lost the radio beam on account of rain static and was drifted west without his knowing it by a strong cross wind. When he started to lose altitude, thinking he was near Newark, he struck some trees at an elevation of 1,400 feet near Milford, Pa. (Merrill's skill and luck brought crew and passengers through a crash landing with practically no injuries.)

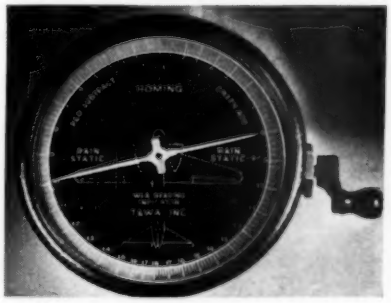
That same night another plane in the vicinity, by using a shielded loop and direction-finder, came home safely.

So Col. Eddie Rickenbacker, general manager of Eastern Air Lines, sat down and wrote a letter to Assistant Secretary of Commerce J. Monroe Johnson, recommending among other things that "all modern air transports be equipped with radio compasses qualified to operate both day and night with antennas shielded against rain, sleet and snow static." He also recommended that Department of Commerce radio stations be equipped with ground type direction-finders to locate temporarily lost ships by the triangulation system.

Soon afterwards (in January, 1937) President Jack Frye of TWA announced a list of equipment essential for safe flying, and headed his list with radio direction-finding equipment.

About three weeks later the big conference of 200 airline operators, engineers and pilots, met in Washington to discuss all phases of safety improvement. They finally decided, since airplane direction-finders were just being perfected at that time and were still highly experimental, that further studies should be made before their use should be required. Department of Commerce officials, however,

First U. S. airline D-F was installed by TWA. Cockpit dial is shown below.



were not for postponing the matter. The Department officials had been much impressed with the successful use of the Coast Guard's cathode ray visual indicating direction-finder, and a few days after the conference the lines were ordered to have direction-finders installed by January 1, 1938.

Radio equipment engineers, already busy as bees in buckwheat, ordered more coffee and dug in to dig out the bugs in their direction-finders. New models began coming on the market. Vincent Bendix' corporation announced that it would offer ten different airplane direction-finders and three ground types. The American Telephone and Telegraph Corporation brought over a French type with a loop that revolved 300 times a minute. Makers of the Simon Radioguide announced a new airline version of their double loop direction-finder which, unlike most others, gives bearings without the loop being turned at all. Variety was the order of the day.

The airlines began experimenting with all kinds. Should visual or aural indicators be used? TWA said experiments with eight different kinds showed that the aural type, such as their original direction-finder, was more efficient, but that a visual type would have to be perfected. Pilots needed to use their ears for other things, such as getting weather reports and instructions from dispatchers.

American Airlines tried out both aural and visual and decided on visual. That line is using Bendix and RCA models more than any others.

All this research in laboratory and plane brought out new knowledge—such as that a loop antenna misses the cone of silence over a beacon station if the loop is mounted on top of the plane rather than on the bottom. Authorities say that aviation radio is in the midst of a wave of progress that sometimes accomplishes more in months than formerly was accomplished in years.

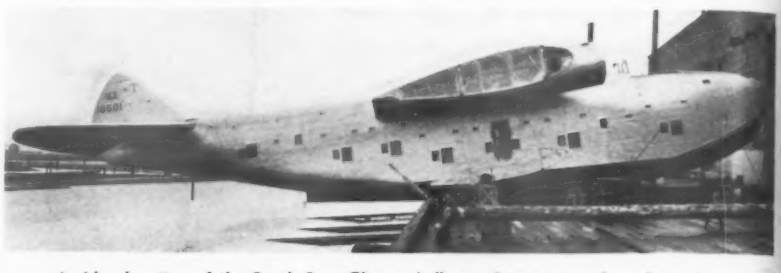
Various advances, such as United Air Lines' trailing wire device for eliminating rain static, have made the need for direction-finders less acute. A simple shielded loop will enable beam signals to come in under moderate static conditions, and the trailing wire device under very bad conditions.

But direction-finders are needed still. Every now and then a beam will lose a pilot. Beams are sometimes bent by electrical "obstacles" caused by mountains, ore deposits or rivers. And pilots sometimes report "phantom" beams. These are "multiple courses" which may be as much as 15 degrees to the side of the true course—enough to lead a pilot into trouble, or to lose him when the "phantom" beam comes to an end in midair. The reason for these is not yet clearly understood and until they can be eliminated it is well for a pilot to have another way of checking his position or finding his way.

The old loop-type beam transmitter is subject to beam shifting, especially at

(*Concluded on page* 92)

South Seas Clipper Nearing Completion



A side elevation of the South Seas Clipper hull reveals its tremendous dimensions.

OUT of its massive "cocoon" of construction scaffolding and into the daylight for the first time, the hull of the world's largest flying boat recently emerged from the assembly building of the Boeing Aircraft Company in Seattle.

The giant 72-passenger Pan American Airways *South Seas Clipper,* with only the inner stubs of its 152-foot wings in place, moved slowly through a wide doorway of the Boeing plant to an outer dock where final assembly and installation work will be completed.

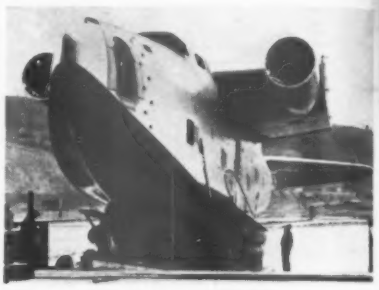
It is the first of six four-engined Boeing Model 314 long-range transoceanic flying boats being produced for Pan American Airways — airplanes larger than the ships in which Columbus crossed the ocean. They are the first planes designed for large scale passenger transportation over the major oceans of the world.

Only a step behind in stage of construction, the Pan American *Atlantic Clipper,* second of the series, stands in another cocoon of scaffolding on the Boeing assembly floor and the hull of the third Clipper will soon take form in the space vacated by the first.

To enable it to be moved out of the building, the big *South Seas Clipper* was placed on a specially-built "beaching gear," a 15-ton eight-wheeled cradle of structural steel with a series of air tanks that will give it buoyancy in the water. Winches and cables were used to move the massive hull onto a ramp in the dock outside the assembly building, where the Clipper will later be launched in the Duwamish Waterway.

So large that it appears more like a surface vessel than an airplane, the highly streamlined hull of glistening aluminum alloy measures 109 feet long from bow to tail. It has an outside surface area of 4,000 square feet—one-tenth of an acre, and an inside volume equal to that of an average five-room house including the basement. The hull itself has a height of 19 feet, while the overall height of the plane is 28½ feet, including the vertical fin of the tail that had to be removed to clear the doorway.

The horizontal tail surfaces, which have an area greater than the total wing area of many twin-engined transport planes now in operation, measure 49 feet from tip to tip and barely cleared the width of the doorway.



Wing stubs and inboard motors.

The giant wings, with a span that would cover nearly half a city block, are to be attached before the launching. Meanwhile Boeing workmen will complete the many details of interior installations while the plane stands at the water's edge. The big two-decked ocean airliner is expected to be ready for flight tests by May.

Here are some astonishing facts about this fifteen-room "flying palace":

Its gross weight (82,500 pounds) is nearly three and a half times the gross weight of the largest overland airliners now in regular service in America. Its four engines alone weigh considerable more than the total loaded weight of the Boeing transports that flew the airlines of America ten years ago.

These engines (1,500-horsepower two-row Wright Cyclones), largest of their type ever built, together develop twice as much power as a railway locomotive, yet each one is confined to a diameter of less than five feet. All the engines and the complete power plant installation can be reached by mechanics during flight by way of passages through the wings. Each of the three-bladed Hamilton Standard constant speed automatic adjusting propellers has a diameter of 14 feet.

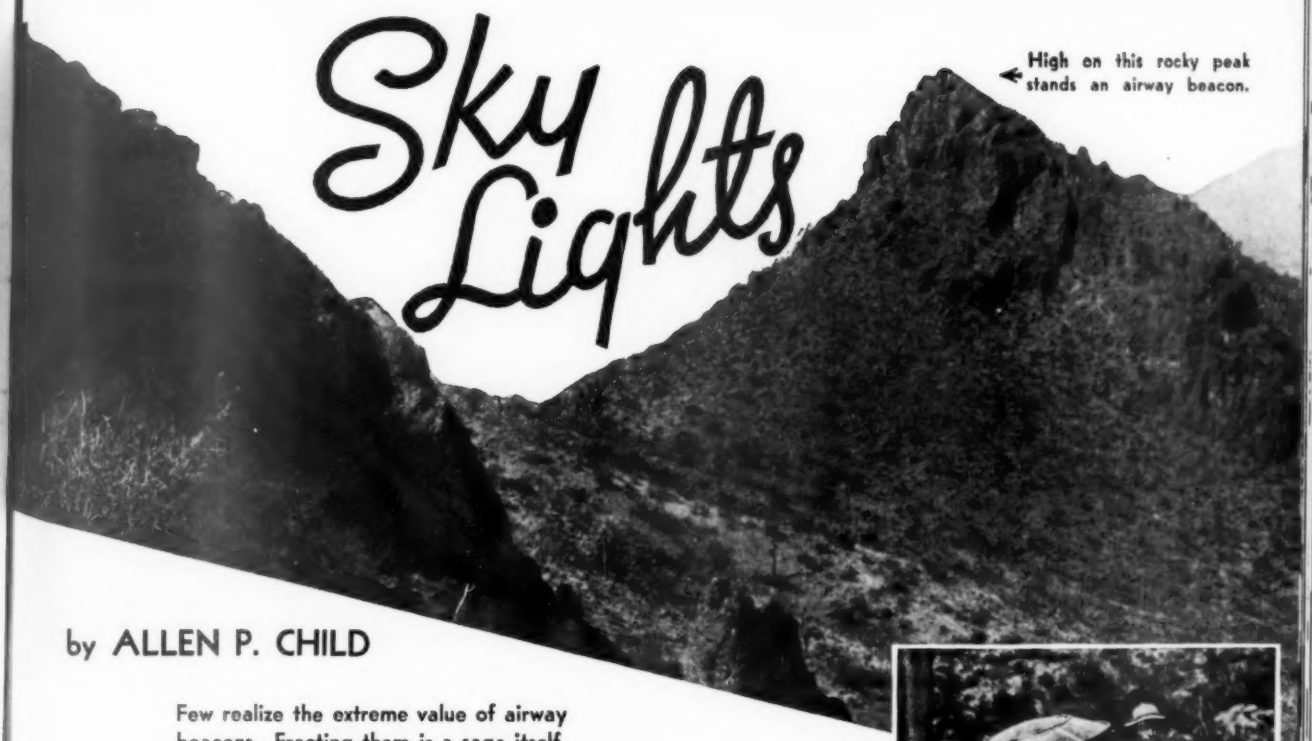
There are 60,000 feet—eleven and a half miles—of electrical wiring in the plane and 3,000 feet of piping. The Clipper's control system involves 5,000 feet of control cable.

The thermostatically-controlled heating system will produce nearly five times as much heat as the heating system of a modern seven-room house.

More than six thousand engineering drawings and 360,000 square feet of

(*Concluded on page* 85)

Sky Lights



High on this rocky peak stands an airway beacon.

by ALLEN P. CHILD

Few realize the extreme value of airway beacons. Erecting them is a saga itself.

THE LIFE of those who erect the sky trail beacons that light the air traveler's path across the wastes of western desert and the treacherous heights of the Rockies is many times rougher than that of the man or woman for whom he toils in the interest of safer aerial navigation. For the passenger in a modern transport plane, surrounded by every luxury of modern transportation, knows little of the heat, the climbing over rocks, the struggle against nature's harshest attributes that the beacon builder endures.

The powerful and large beacon, known as the 36-inch double-end beacon, is used in many locations which are difficult of access. Lighting the way across Death Valley, or over the romantic regions of Alaska as well as the silent, dusty plains of Kansas or tipping the peaks of the Rockies these big beacons have to be built in sections so that they can be carried to their positions piece by piece.

After an airway survey has been made, a number of possible locations for beacons, about 15 miles apart in as straight a line as possible are selected. But still further examination of each selected site is made to be sure that some nearby spot would or would not be the ideal location. When the beacon is mounted on a tower it must be visible for at least 15 miles from a height of 1,000 feet. If an electric supply is not near at hand plans must be made to bring in the bulky machinery for a gas-electric set so that the beacon will have current for its light and its operating motors.

To find the proper locations, surveyors traverse the hot sands of deserts, blaze new trails through primeval forests, scramble over cliffs and crags. When once the spot for the beacon has been determined the various parts of the tower, the lights, tools, gasoline, oil, poles, cable and a hundred other things are loaded on trucks. Many times the duty the trucks perform is short-lived and the thousand and one things that make up this revolving finger of light have to be carried over rocky ground and up steep hillsides on the backs of burros. Food and sleeping equipment for the workers has to be carried to the camp site in the same way.

The first things to go to the spot where the tower is to be erected are tools and dynamite for clearing a site for the foundation. While one part of the crew is getting this part of the work accomplished another group is setting up the power house where the gas-electric sets will furnish the power for the beacon. As a rule this building is not very near the tower for it is easier to put in a pole line to carry the current than it would be to transport the equipment. But still the erection of the pole line and the cables is no afternoon playtime game for more often than not the poles must be set in solid rock and the line itself may go straight up a hundred feet for every ten feet it goes ahead.

The tower is in sections and as fast as the burros can get them up they are assembled for, as a rule, there is no place to store them until they have all been brought up. After the tower is completed the task of bringing up the beacon and lights begins and each burro has some part of this delicate equipment strapped to his back for the slow, laborious trip through cactus and over rocks. When

(*Concluded on page* 91)

With peaks and trails so rugged that burros must be used, beacon builders face danger constantly. The burro above is carrying a lens up to a beacon.

Fiery crashes and hair-raising air stunts actually are big business in Hollywood. Here is the story of the Associated Motion Picture Pilots, a closely-knit band of "we'll-try-anything-once" airmen who have been thrilling movie-goers for years. But—don't believe all you see.

With the exception of Stuntman Tex Rankin, here is the entire roster of the Associated Motion Picture Pilots. Standing, from left to right, are Ace Bragunier, Herb White, Paul Mantz, Frank Clarke and Earl Robinson. Seated, left to right, are Dick Grace, Howard Batt, Frank Tomick and Jerry Phillips. These men do all movie air stunts.

SUICIDE CREW

By
SELBY CALKINS

The veteran Dick Grace sits in the padded cockpit of this "shot-down warplane."

A MOVIE exhibited in your town not too long ago ended as a young Army pilot renounced the beautiful heroine to his pal, climbed into a speedy fighting plane and took off—straight to blazing destruction against the trunk of a tall tree at the end of the runway!

The sound track recorded the sickening, splintering crash as you saw the plane crumple and go hurtling to the ground. The upper half of the tree, torn off by the impact, fell on top of the wreckage. A spurt of flame burst out and made a fiery bier of the twisted pile of torn fabric and splintered wood.

You didn't see the pilot—mercifully. The camera switched sharply to a group of actors whose faces mirrored gripping horror at the tragedy of swift death striking.

"What a horrible death!" gasps the impressionable movie fan. Not so the cynic—the "wise guy."

"More movie baloney," he says. "Hollywood trick stuff—nobody could really do that—don't waste your sympathy!"

And probably 90 per cent of the audience would believe the same thing. They'd believe that such a crash would *have* to be faked; that it would be too dangerous for any pilot to attempt as a mere "stunt" for a movie.

That 90 per cent would be wrong.

Here is what really happened the day that scene was filmed:

The young pilot—of course, he was one of Hollywood's most famous stars—climbed into the plane and pulled down his goggles as whirring cameras caught every move. He gunned the throttle a couple of times—and then climbed right out of the plane again.

His place was taken by another young man, dressed in identical clothing, who went through the same motions except that when *he* gunned the throttle the plane began to move as he poured full power to the motor.

The fast little ship picked up terrific speed. It drove straight at the tree and struck precisely where it had been sawed partly through in preparation for the "stunt." The pilot, strapped and braced for the first shocking impact, ripped himself loose and reached for a rocket pistol as the wreck hit the ground.

Coolly he glanced up, ducked under a shattered wing when the tree-top came tumbling down, then fired his rocket pistol into the gas tank and crawled out of the ruins away from the grinding cameras just far enough to avoid danger from the flames.

There he lay flat until the fire died down and he was sure the camera crew had duly recorded his "death."

Then he went home.

Out here in Hollywood the men who make motion pictures know that few aviation scenes have to be faked. They know that this particular scene, and hundreds of others as spectacular and thrilling, were real; that there is a suicide crew—ace pilots all—on call in Hollywood to deliver almost any kind of a blood-chilling crash, daring stunt or "impossible" maneuver a frenzied scenario writer might devise.

They will snort in derision if you call them daredevils—they are the Associated

Don't believe your eyes too much when you see M-G-M's "Test Pilot" soon. The above crash is supposed to be a "Flying Fortress." Actually, it is an old Douglas DC-2 with two dummy engines added. Stuntman Frank Clarke crashed this one.

Motion Picture Pilots, if you please. Their job is to accept such risks—and then find a way to do the impossible without breaking their necks.

Veterans of the flying world, the Associated Motion Picture Pilots have attained a perfection of aerial skill and pure technique that would bring them instant fame if turned to other flying pursuits.

Yet of this roster—Howard Batt, Clarence "Ace" Bragunier, Frank Clarke, Dick Grace, Paul Mantz, Jerry Phillips, Tex Rankin, Earl Robinson, Frank Tomick and Herb White—how many do you know?

It was Frank Clarke who mowed down that tree.

Did you see a picture not long ago in which a pilot rolled his wheels on the roof of a hangar, then did a wing-over and flew back through the same building with only inches to spare at his wing tips? That was Paul Mantz.

Remember the cycle of war pictures a few years ago in which each succeeding film seemed to surpass its predecessors in spectacular crashes? Dick Grace was responsible for that destruction of aircraft.

And do you remember another film in which an Allied plane dove on a German airport to bomb a "sitting bird"—and was blown up by the same blast?

That was Earl Robinson, in one of the narrowest escapes that any of this death-courting crew has ever experienced.

The scene—one of the most thrilling ever filmed—was a mistake. Robinson

This crash in "Young Eagles" looks deadly, actually hurt no one. Veteran Dick Grace got "shot down" in front of the cameras, awaited the "enemy" (left).

was supposed to bomb the plane on the ground, but he wasn't supposed to be blown up with it!

Robbie was ordered to power-dive at the plane from a dizzy height and release a dummy bomb when he pulled out of the dive. Hidden under the target was a charge of high explosive with wires leading to a detonator out of camera range and in the care of a property man. His job was to push the plunger and blow the target ship to pieces—*after* Robinson dropped his dummy bomb. That would give Robbie a split second to get out of range.

Motor roaring and wires screaming, Robinson dove. Almost on top of the grounded plane he released his bomb—and the property man set off *his* blast!

Robinson's ship was blown 100 feet into the air—parts of the destroyed plane bombarded him—he felt his ship lurch out of control—the tail surfaces had been blasted away. Sure that a crash was coming, Robbie tore off his goggles to save his eyes. Every resource, every ounce of skill, every bit of the air lore of all his thousands of hours of flying crowded into his mind as he fought to land his crippled ship.

He cursed the property man, the ground crew, movies in general and the day he learned to fly as he fought for control with only his ailerons and motor. The ground rushed at him and with wings wobbling he struck—lurched on one wheel—felt a wing tip dig in and—the world spun around him as the plane lunged end over end.

"What a swell club!" was his next conscious thought. The control stick was loose in his hand, torn free in the crack-up.

Ignoring anxious rescuers, Robbie "went hunting for the nervous — — — who set off that — — bomb!" The nervous—ergent had left for home—but the cameras had filmed every nerve tingling second of Robinson's brush with death. The result was a scene awesomely realistic—and instantly branded as a fake when the picture was released!

Of course, the star of the film was the survivor of the crash—the Associated Motion Picture Pilots are the unsung heroes of the sky dramas because they have made a cold, matter-of-fact business of this dizziest calling in a dizzy world.

These ten men, in an organization as exclusive as any centuries-old London club, are responsible for every aviation scene you see in a modern motion picture, whether it be a spectacular crash, a "dog fight" above the clouds, an aerial chase scene or routine footage of an airliner in flight.

A member must be a true master of his trade; qualified and splendidly able to fly anything from a tiny flivver plane to a huge amphibion with machine-like precision. He must hold an unlimited commercial license and obtain a permanent waiver from the Department of Commerce to permit low flying and stunting, operation of unlicensed aircraft and other infractions of the law of the air.

His skill as a pilot will not be his only asset. He must know cameras and "camera angles" and be able to work in harmony with his director in obtaining effective "shots".

He may be called upon to contribute authentic slang for a studio script. One day he may be asked to build a model airplane to scale for a director's youngster and the next day dive an old OX-5 job into the ocean.

He will frequently be called upon to take his turn as technical director to rule inflexibly on dialogue and dress of characters, suitability of equipment and find "locations" for his motion picture.

He may be commissioned to find, in an aerial search, a place that looks like the English countryside, for the association even supplies foreign lands and weather on occasion. The Pacific Coast has its snow-clad Alps or Andes, its sand dunes and beaches, deserts, rolling plains and farm lands to duplicate any spot in the world at any time of the year. Through long experience and systematic listing the pilot organization knows of scores of fields that may be converted to "location" airports duplicating any in the world.

"Hello, Newark! I think I've located that missing shipment of champagne!"

And sometimes your motion picture pilot is called upon to get himself out of fantastic messes not of his own making. One such instance is a classic anecdote in the organization.

A lone pilot was hired to perform in several scenes in a war picture—a "quickie" movie being made at a minimum of expense.

Flying a war-time combat plane that had somehow reached Hollywood but should have been in the boneyard long since, Frank Tomick had completed all but the last scene, in which he was to fly down the crooked, narrow street of a French village machine gunning "German" troops defending the town.

The street had been constructed at considerable expense for use throughout the picture. The plane had been used in nearly every scene.

And then when the time arrived for that last thrilling episode—last, incidentally, because of the danger to Tomick—he found that the street was a foot narrower than the wingspread of the plane!

Dutifully he reported his discovery. It created a furore. Rebuilding the street would be so costly as to ruin the picture's budget. Getting a smaller plane would necessitate the re-shooting of all previous scenes and likewise ruin the budget.

The director announced the impending loss of his sanity. The set-builder responsible for construction of the street left quietly to look for another job. Everyone down to the property boy rallied 'round to discuss the disastrous problem.

Tomick stood silently by, twirling his helmet and goggles. Finally someone thought to ask him for advice.

"Who, me?" he growled. "Huh, I'd just saw a couple of feet off the wings of the plane."

And that was that.

Regardless of the wide variety of problems with which your motion picture pilot may find himself confronted—or perhaps because of it—ingrained in each of them is a love for his work. Much of this attraction certainly must spring from the satisfaction they gain in knowing that there are thousands of pilots—but only ten who can fill this unique need in the billion dollar motion picture industry.

In addition to broad training for their profession the members individually have specialized talents—each has a perfection in some phase of motion picture flying to which he has devoted long hours of study and practice.

Howard Batt is a superlative flyer—and an expert on commercial aviation; Ace Bragunier is a stunt man, sky writer and a "big ship" pilot; Frank Clarke and Dick Grace excel at crack-ups, knowing just how far they may trust to skill and painstaking preparation and where they must leave off before depending on pure chance; Paul Mantz knows airplanes, past and present, as do few other authorities and ranks among the best as a precision flyer.

Jerry Phillips has a knack for deliberately erratic flying close to the ground—give him a ship, any size, and he will thrill you to exhaustion without getting more than ten feet in the air; Tex Rankin is a precision flyer who sends an airplane through the most involved gyrations with perfect timing and inside whatever area is marked out as within camera range; Earl Robinson can power-dive a plane to within inches of a given target from a dizzy height; Frank Tomick and Herb White are equally at home in stunting planes or at the controls of camera ships. As pilots of the

(Continued on page 75)

MAILMAN Overboard!

This exclusive picture shows Lindbergh (right) and his wrecked ship.

Being the report of an emergency parachute jump made

by CHARLES A. LINDBERGH

The author of the report below is star figure in the world's most exclusive organization—the Caterpillar Club. Lindbergh is a four-jump member.

NOWHERE in the annals of aviation can be found a more dramatic first person story than the one written by Colonel Charles A. Lindbergh on November 4, 1926, in which the famous flyer describes the circumstances under which he was forced to abandon his plane over Covell, Ill., the preceding day. From an unimpeachable source, this graphic report has come to POPULAR AVIATION and the editors are glad to pass it along to our readers, since it expresses the innermost thoughts of a tall young mail pilot who was to rocket to world-wide fame a few short months later. It is written by a real pilot in real flying language:

REPORT OF NORTHBOUND MAIL FLIGHT, NOV. 3, 1926 BY CHARLES A. LINDBERGH, PILOT C.A.M. NO. 2

(Editor's Note: Lindbergh's run was then between St. Louis and Chicago with intermediate stops scheduled at Springfield and Peoria, Ill. The route was then being operated by the Robertson Aircraft Corporation.)

I took off from Lambert-St. Louis Field at 4:20 p. m., November 3rd, arrived at Springfield, Ill., at 5:15 and after a five-minute stop for mail took the air again and headed for Peoria.

The ceiling at Springfield was about 500 ft., and the weather report from Peoria, which was telephoned to St. Louis earlier in the afternoon, gave the flying conditions as entirely passable.

I encountered darkness about 25 miles north of Springfield. The ceiling had lowered to around 400 ft. and a light snow was falling. At South Pekin the forward visibility of ground lights from a 150 ft. altitude was less than ½ mile and over Pekin the town lights were indistinct from 200 ft. above. After passing Pekin I flew at an altimeter reading of 600 ft. for about five minutes, when the lightness of the haze below indicated that I was over Peoria. Twice I could see lights on the ground and descended to less than 200 ft. before they disappeared from view. I tried to bank around one group of lights, but was unable to turn quickly enough to keep them in sight.

After circling in the vicinity of Peoria for 30 minutes I decided to try to find better weather conditions by flying northeast towards Chicago. I had ferried a ship from Chicago to St. Louis in the early afternoon and at that time the ceiling and visibility were much better near Chicago than elsewhere along the route.

Enough gasoline for about one hour and ten minutes flying remained in the main tank and 20 minutes in the reserve. This was hardly enough to return to St. Louis even had I been able to navigate directly to the field by dead reckoning and flying blind the greater portion of the way. The only lights along our route at present are on the field at Peoria, consequently, unless I could pick up a beacon on the transcontinental route my only alternative would be to drop the parachute flare and land by its light together with what little assistance the wing lights would be in the snow and rain. The territory towards Chicago was much more favorable for a night landing than that around St. Louis.

I flew northeast at about 2,000 ft. for 30 minutes and then dropped down to 600 ft. There were numerous breaks in the clouds at this time and occasionally ground lights could be seen from over 500 feet. I passed over the lights of a small town and a few minutes later came to a fairly clear place in the clouds. I pulled up to about 600 ft., released the parachute flare, whipped the ship around to get into the wind and under the flare which lit at once but instead of floating down slowly, dropped like a

rock. For an instant I saw the ground then total darkness. My ship was in a steep bank and for a few seconds after being blinded by the intense light I had trouble in righting it. I then tried to find the ground with the wing lights, but their glare was worse than useless in the haze.

When about ten minutes' gas remained in the pressure tank and still I could not see the faintest outline of any object on the ground I decided to leave the ship rather than attempt to land blindly. I turned back southeast towards less populated country and started climbing in an attempt to get over the clouds before jumping.

The main tank went dry at 7:51 and the reserve at 8:10. The altimeter than registered approximately 14,000 ft. yet the top of the clouds was apparently several thousand feet higher. I rolled the stabilizer back, cut the switches, pulled the ship up into a stall and was about to go out over the right side of the cockpit when the right wing began to drop. In this position the plane would gather speed and spiral to the right, possibly striking my parachute after its first turn. I returned to the controls and after righting the plane dove over the left side of the cockpit while the airspeed registered about 70 miles per hour and the altimeter 13,000 ft.

I pulled the ripcord immediately after clearing the stabilizer. The chute functioned perfectly. I had left the ship head first and was ralling in this position when the risers whipped me around into an upright position and the chute opened.

The last I saw or heard of the D. H. was as it disappeared into the clouds after my chute opened. I placed the rip cord in my pocket and took out my flashlight. It was snowing and very cold. For the first minute or so the parachute descended smoothly then commenced an excessive oscillation which continued for about five minutes and which I was unable to check.

The first indication that I was near the ground was a gradual darkening of the space below. The snow had turned to rain and although my chute was thoroughly soaked its oscillation had greatly decreased. I directed the beam from the 500 ft. spotlight downward but the ground appeared so suddenly that I landed directly on top of a barbed wire fence without seeing it.

The fence helped to break my fall and the barbs did not penetrate the heavy flying suit. The chute was blown over the fence and was held open for sometime by the gusts of wind before collapsing. I rolled it up into its pack and started towards the nearest light. Soon I came to a road which I followed about a mile to the town of Covell, Ill., where I telephoned a report to St. Louis and endeavored to obtain some news of where the ship had landed. The only information that I could obtain was from one of a group of farmers in the

(*Concluded on page 78*)

The MAN UNDER THE HOOD

By D. W. W.*

PRESIDENT ROOSEVELT is a Navy man at heart and he steps in where admirals fear to tread. . . . I refer to his flat statement recently reported in newspapers that airplanes cannot be considered as serious adversaries of battleships. . . . That old argument has been going on ever since the late Billy Mitchell showed up the Navy back in 1922 by easily sinking the dismantled German battleships off Virginia. . . . Even if he is the President he can't know everything, and the Army experts tell your snooper confidentially that a 2,000 pound bomb will do anything that's wanted to any ship afloat.

* * *

Here's some more hush-hush engine information. . . . The Lycoming engine company at Williamsport, Pa., has spent more than a million dollars developing a new high horsepower liquid-cooled motor. . . . This engine is different. . . . It's a 12 cylinder flat engine with the cylinders 180 degrees opposed. . . . The idea is that it will fit entirely inside a relatively thin section airplane wing. . . . Thus eliminating much drag, and making more speed possible for given power. . . . It's supposed to be an Army-Navy secret and develop about 1,000 h.p.

* * *

Remember we told you the British are about to make an attempt on the world landplane speed record, now 379 m.p.h. and held by the Germans. . . . The Society of British Aircraft Constructors Ltd., announced in a recent bulletin that one of the new Supermarine *Spitfire* fighters with a 1,020 h.p. Rolls-Royce engine probably will try to set a new mark this summer. . . . The British, you know are all veddy cheery over the flying of their other new low-wing fighter, the Hawker *Hurricane*, which made a 327 mile flight at night last February at a speed reported to have been 408.75 m.p.h. . . .

* * *

Lucky are certain young men now attending Massachusetts Institute of Technology. . . . W. A. (Pat) Patterson, United Air Lines' dynamic young president, is planning to get this number at next graduation and mould them into pilots for his company. . . . Pat says he can't get quite the material he wants from the service schools. . . . So he's starting a plan of his own. . . . The company will send the lucky fellows through the Boeing school at Oakland airport and pay them something like $65 a month to boot. . . .Pat says that what he wants in his cockpits are engineers, not solely good pilots.

* * *

Also about Pat: He had a piece in the Saturday Evening Post recently and made the mistake of titling it "Who's Flying this Ship?" . . . He then told how the automatic pilot—Iron Mike to you old QB's—did all the work 80 percent of the time. . . . It's got the human pilots of his and other big lines slightly riled up. . . . They point to the fact that while the Sperry giro-pilots are nice gadgets, they frequently fail. . . . And they have, at times, put transport liners through some pretty mean maneuvers before the men in the cockpits could fight back. . . . The pilots are right too, as even Sperry engineers will admit.

* * *

The A. L. P. A.—you know, the Air Line Pilot's Association—has a little joke all its own. . . . It's pressing a campaign to get all the Iron Mikes on the airlines into the association. . . . Incidentally the A. L. P. A. in the United States has a sister—or should it be brother—association in England where the pilots have recently formed an organization copied after and affiliated with Dave Behnke's outfit.

* * *

What do you know about this! . . . The Royal Flying Corps, pride of the British Isles, has had to purchase the Browning .50 caliber airplane machine gun—which is a beastly American product. . . . The reason: there was no satisfactory heavy machine gun manufactured anywhere in England or Europe of that power. . . . The British will build their own under American license.

* * *

Do any of you birds who read this column like it? . . . About the only word your instrument pilot gets is from them as is after his scalp. . . . If there is in our reading public a gent with an approving noise to make, it would be most welcome and encouraging. . . . Just about every manufacturer, or airline company that has been mentioned here has moaned. . . . Mostly because they insist we have printed matters considered strictly private.

* * *

Does anybody want to know how the new Hamilton-Standard full feathering props work? . . . They're still a very, very Army secret but we'll let the cat out of the bag. . . . They are a simplification of the constant speed job, the counterweights have been eliminated. . . . There is the usual cylinder with a cam which moves on a spiral grove

(*Concluded on page 94*)

*The author is one of the best-informed aviation men in the country, withholding his identity in order to maintain complete freedom of comment.—The Editors.

Flying Home On Sealskin

R-M, the big Junkers freighter that played the lead in this northern drama, is shown at anchor on the Red River.

by EDWARD GREEN

This is one of the most unusual aviation adventures we have seen in a long time. Proving that those Canadians can take it.

IT is bleak and cold at Eskimo Point on the western shore of Hudson's Bay. The crew of the big Canadian Airways freighter, a Junkers, familiarly known as R-M (its Canadian registration letters are CF-ARM) found it so and were glad they had almost completed their hauling contract. One more load of freight into Padley, a Hudson Bay post 160 miles inland and they would be finished.

But it wasn't going to be as simple as that. During the night a northwest wind sprang up and began to whip the black waters of the bay into foam. Two more smaller Junkers planes were out on the unprotected rocky beach too. One of them was drawn up out of danger but before the other one could be brought to safety she was blown ashore and her fuselage broken.

Meantime, R-M was riding at anchor, and Buck Buchanan, her veteran pilot, decided to try and get out to her in order to be in readiness should anything serious develop. Buck and his men were still debating how to get out to R-M when her anchor chains broke and she was driven on the rocky shore by the howling gale.

Eighty thousand dollars worth of airplane was being pounded up and down on the jagged rocks. Each bump knocked a hole in the floats. Water poured in, but the ship kept pounding away. The thin duralumin was being torn to shreds.

But there was nothing Buchanan could do. He and his men stood waist deep in that icy water through the black night and tried to keep their ship off the rocks, but it was an impossible task. When day dawned, R-M's floats were ruined.

When the tide went out at dawn, Buchanan and his men examined the damaged floats of their big ship. They were in a pitiful state. Seventy-five per cent of the starboard float was gashed and torn. The step was flattened and in the third compartment from the rear a boulder weighing 150 pounds was driven right through the bottom and jammed against the bulkheads. To even contemplate repairs seemed hopeless.

But winter was at hand and the ship must be gotten out of there and back into Winnipeg. Time was precious. Every hour must count. Buchanan and his crew started to work.

Their first difficulty lay in the fact that their ship weighed more than five tons and they had no jacks or other means of lifting it in order to work on the floats. They dug trenches beneath the floats and while some crew members kept the trenches baled partially dry, the others went to work with the patching materials they had on hand.

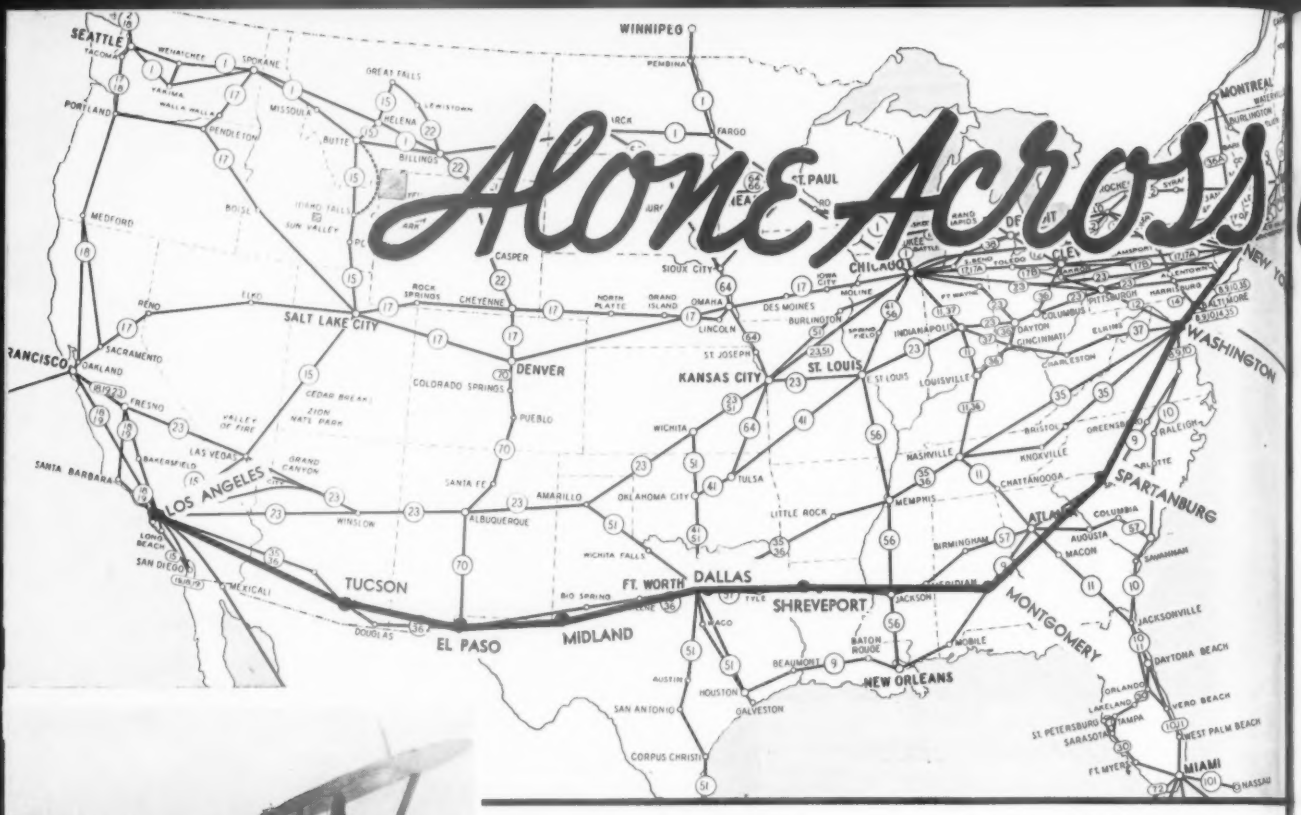
But these materials were woefully inadequate for such a big job. Others

(Concluded on page 78)

The ship's starboard float at the end of its flight home. The X's mark the sealskin patches, the O's circle holes.

Here is R-M's crew working feverishly on her battered pontoons. Note the huge boulders that all but wrecked the ship.

Alone Across



Map courtesy of the Official Aviation Guide.

Above is the route Colonel (then Major) Eaker and Major Kepner followed from New York to Los Angeles. The tiny pursuit ships flew in formation all the way.

Above is the author's tiny Boeing P-12 fighter with its special hood.

"YOU are over the ocean west of Mines Field now, Ira, you can uncover," came the calm voice of Bill Kepner. I reached up, unlatched the cover which shrouded my cockpit, rolled it back and stuck my head out into the clear, California sunshine. A deep breath of sea-washed air was a great relief after smelling burning oil and feeling the hot breath of my engine for more than 23 hours. Just as my imagination had pictured it so many times on the long trek across the continent, there below me lay red-roofed Santa Monica; on the left was the blue Pacific; to the right sprawled magic Los Angeles; in front were the brown Santa Monica Hills. It was the end of the journey. The first flight across the continent blind, entirely by instrument aid, was finished. . .

This transcontinental blind flight was not the result of a sudden impulse. A long trail of incidents and accidents spread over more than 18 years of flying spawned the idea and prompted the deed.

The genesis was in the Philippine Islands on a Sunday afternoon. Occasional rain squalls were beating the airport on Pasay Beach, but I was unfamiliar then with tropic rains. Expected back at the Army post at Stotsenburg, I took off and turned north toward dark clouds hanging over the end of Manila Bay. In a few minutes I ploughed into the van of a typhoon which was whipping up out of the China Sea. In a moment it was dark as night, though it was mid-afternoon. The rain descended in liquid sheets. I could see nothing. The plane, my old black DeHavilland, began to do queer things. One moment the controls seemed light and of no effect. The next I was thrown up against one side of the cockpit. I knew the plane was not right side up, there was no telling which side was up. We had no parachutes in those days. It looked bad. The plane evidently was headed downward at an alarming rate, but I seemed unable to do anything about it. As I held a hand before my eyes to keep out the stinging rain, suddenly a yellow mat appeared below; it made a horizon; I jerked the plane to the horizontal and pulled up the falling nose just before it struck the water. It was a close call. But that was not what alarmed me. For the first time I found that I could not fly when I could not see! Had it not been for the fact that the waters of Manila Bay near shore are yellow, making a contrast with the dark green rain, I should have dived into that placid surface. Some say that the flat shores of Manila Bay and the muddy, passive water present an uninteresting prospect. To me they will always be a beautiful land-seascape.

That night I must have been reticent and moody at dinner, for Charles T. Phillips, now a Lieutenant-Colonel in the Air Corps, my roommate, said: "Was the senorita unresponsive this week-end, boy?" It was not the senorita; it was not the fact that I had that afternoon tweaked the long beard of the old man with the scythe and hour-glass. It was the fact that I had discovered an alarming weakness in my flying ability. I did not know that other pilots could not fly blind. I assumed that the trouble lay with me. In those days a flyer did not admit an inferiority. Flying men were known by their deeds. If in the morning a pilot landed out of one turn of a spin, that afternoon you landed out of two turns of a spin. Only the best survived. Well, perhaps that is not true. I have always said that the greatest flyers are dead. Perhaps it was the lucky who lived.

On a morning not long after, low clouds hung over our flying field. I suggested to Lieutenant Longfellow that he take up a DH and fly a while in the clouds. I rode in the back seat. A few minutes after he pulled up into the fleecy canopy, the plane fell into a tail spin. I could see that he looked worried and chagrinned, but I could have cheered for joy. Another pilot, one whose flying ability I admired, could not fly blind. We landed and put our heads together. I told him of my earlier experience. We began to practice cloud flying and when the clouds were not there we chalked our goggles to simulate blindness. We got better, but we were never able to hold a true course. The compass would eventually start rotating and the plane would take up unwanted maneuvers. We borrowed a carpenter's level and set it on the top longeron in the cockpit to tell us by its bubble when the plane was true fore and aft. This helped some, but it

America - BLIND!

by LIEUT.-COL. IRA C. EAKER

★

This is the first time the whole story of this remarkable instrument flight has appeared in print. Written exclusively for POPULAR AVIATION by the Air Corps officer who made the flight, it is a document that should make Americans proud of their military flyers. Colonel Eaker is a Caterpillar as well as a member of the Army's first good-will flight to South America in 1927.

★

The author, Lieut.-Col. Ira C. Eaker

did not stop the turning tendency. We were licked. Our answer was to stay out of zero visibility, not to fly when we could not see the ground.

A few months later, we received from the States a little clock-like instrument. At its base it had a liquid tube with a steel ball in it, something like a carpenter's level, but at its top it had a needle which would turn right when the ship turned right and left when the plane turned left. It was called a turn and bank indicator. That was what we had been dreaming about. With it, after a little practice, we could fly in the clouds; we could hold a course when the horizon disappeared. For us the dawn of instrument flying was breaking.

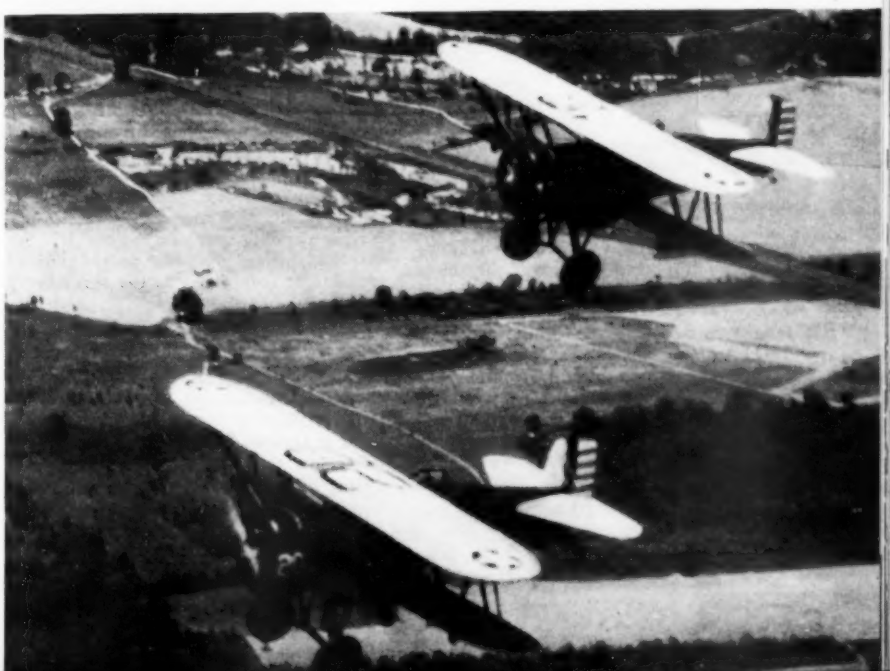
The early reactions of the old flyers toward airplane instruments was a peculiar thing. Real flyers flew by "feel", they said. These fellows who had to have a lot of gadgets to fly were inferior sissies. "What," said they, "does a man need a thermometer for; can't he smell the burning oil, can't he see the radiator boiling over?" It was the same with the flight instruments. "Just a few more trinkets to hang on the old bus," they opined. "Pretty soon the old Christmas tree will be so loaded down she won't take off."

There is a classic story told about a flyer who fixed an instrument. If you knew the old timers, it is not quite as crazy as it sounds. There was an instrument called an ammeter. Its needle pointed right when the battery was charging, left when it was discharging. When it pointed left, that was a danger signal, the engine would stop if that continued for more than two hours. One day a pilot was flying over from Dayton to Washington. He noticed that his ammeter was reading "discharge". It bothered him; its mechanism was a dark mystery; he could not fix it, but he knew how to make that warning needle behave. He broke the glass face of the instrument and bent the needle until its crooked hand pointed to "charge"!

Many wrecks along the air trails which have gone down in the books as "unexplained", are not such mysteries to the flying brotherhood. They know that the pilots got in over their heads; they either did not use their instruments or these did not function properly. The latter is rare.

Let us take off and fly over a period of many years, as more and more instruments were being hung in airplane cockpits despite the headshaking of the old fraternity of "flyers by feel". We come to those hectic days when the Army carried the mail.

One night I lay under the wings of a bomber out in Mojave desert; I had hit a storm and landed. Head propped on my parachute, I was trying to get a few



This action shot shows Eaker's ship (No. 20) and Kepner's on the flight.

winks of much-needed sleep. I was awakened by a pilot on my run who was standing over me. My flashlight showed his troubled face. He had been on the West-bound run, and had hit the same storm I had struck going East. He was an enthusiastic youngster of but two years' flying experience. Without warning he had flown from a black night into that squall in the desert.

He said: "Captain I have learned tonight how pilots get killed. Without the slightest warning I flew into the middle of a terrible storm. Everything went blind. It was very rough, the ship was tossed around like a toy. The first thing I knew it was out of control. Then it began to spin. I couldn't get it righted. It never occurred to me to jump; I cut out completely. For some reason I released the parachute flare. By its glare, just before I struck the ground, I saw the earth's dim outline. I pulled the nose up and the first thing I knew the plane was rolling along on the ground."

Next morning, as I flew over his plane, it sat on the edge of a dry salt lake. If it had landed a mile on either side it would have rolled up into a ball in the rocks and sage brush. We should have had another unexplained accident. That boy had learned out over the Mojave in 1934 what I had discovered over Manila Bay in 1920, by a similar experience . . . your so-called senses are the biggest liars on earth, you can't fly when you can't see, save by instrument aid. For some reason he had failed to use his instruments or he could not see them. He could fly by instruments; he had to demonstrate that ability before he could graduate from the Air Corps Flying School, but he had "cut-out" as he freely admitted.

A few months later, when we returned from Air Mail and took up our regular routine of military flying at March Field, I began to worry about our situation there. We had pursuit planes, little single-seaters, equipped with but one flight instrument, the turn and bank indicator. There was not room for more on the tiny instrument board; even the compass had to be mounted on the top wing, because of the congestion in the cockpit. I had learned by experience and practice that there was a distinct difference between flying the big transport planes fully equipped with the latest instruments and flying pursuit planes under similar conditions of poor visibility. I asked General Arnold, our Wing Commander, for permission to adapt a cockpit cover for our pursuit planes and give our pilots practice in flying single-seaters blind. Ready (as he always had been since being taught to fly by the Wright brothers in 1911) to undertake or support any experiment which would promote the progress or safety of flight, he said, "Go ahead, but stay up high so that you will have time to uncover if you get in trouble."

Lieutenant Frank Cook of March Field and I devised a blind canopy and he built it, doing an excellent job; it served our purpose perfectly. The little cockpit was completely enclosed and the pilot was bereft of any outside vision when our cover was closed. Flight had to be by instrument aid. With that device installed on a Boeing P-12 pursuit I began the tests. Due to the greater maneuverability and instability designed into this little ship to give it suitable acrobatic qualities for air fighting, it was much more difficult to pilot blind than larger planes with more instruments and greater inherent stability. After about three hours under this hood, however, I could steer a reasonably good course and could hold the plane in level flying attitude. It was with that cockpit cover and a P-12 plane powered by a Pratt & Whitney *Wasp* engine that I made the first transcontinental blind flight. The only other change found necessary was to mount a compass inside the pilot's compartment, for, when the canopy was closed, sealing the cockpit, vision of the compass on the top wing was necessarily cut off.

Come sit with me in the little plane on a leg of this flight. As a matter of fact, you can't do that, as the tiny ship is a single-seater, there is scarely room for me, so I'll tell you about it. Just after take-off, and when I have climbed to 2,000 feet over the field, I pull the canopy forward and latch it just under the windshield. This canopy is built on the principle of a baby buggy top. It has a series of oval ribs like a fan, covered with heavy canvas. When it is fastened forward the canvas is taut, making a tent under which the pilot sits. It is built to conform to the shape of the cockpit perimeter, excluding not only outside vision but most of the light as well. To care for that, there is a little electric light bulb set in the center of the instrument board which sheds its light on the board. The power for this light is taken off the battery. By its glow can be seen the turn and bank indicator, on which I keep a constant watch, for by it alone can I tell when the plane is flying true. Just to the left of it the compass face can be seen to tell me my course; by holding this compass needle at 270 degrees, for example, I know the plane is flying west. There are also on the instrument board before me, which I could touch with my head if I leaned forward, the engine instruments—an oil temperature gauge, an ammeter, an oil pressure gauge, and a rate of engine revolution indicator. These I glance at only occasionally to make sure the engine is running true. To my right is the dial for setting my radio at the desired frequency; to my left is the throttle by which I control the engine speed; below, between my feet, mounted on the floor is the generator for the radio and the radio installation. My feet rest on the rudder pedals, and up between my knees is the little stick control which my right hand grasps as I steer the little craft. I sit so low that my right elbow can rest on my knee and that is well, for it holds down the map. On this map I plot my course. That is not necessary, for I can tell by the radio where I am, but it helps to pass the time, as it shows me graphically the progress of the flight. Inside my helmet are earphones so that I constantly hear the radio. There is little chance for change of bodily position, as my shoulders almost touch either side of the cockpit, and if I move, it causes my feet to kick the rudder pedals, disturbing the forward movement of the plane in its straight course. The air in the little cabin is none too pure; I suspect from the headaches I get that there is carbon monoxide gas; also there is a smell of burning oil and it is very hot, as the ventilation is poor; we have sealed the cockpit well.

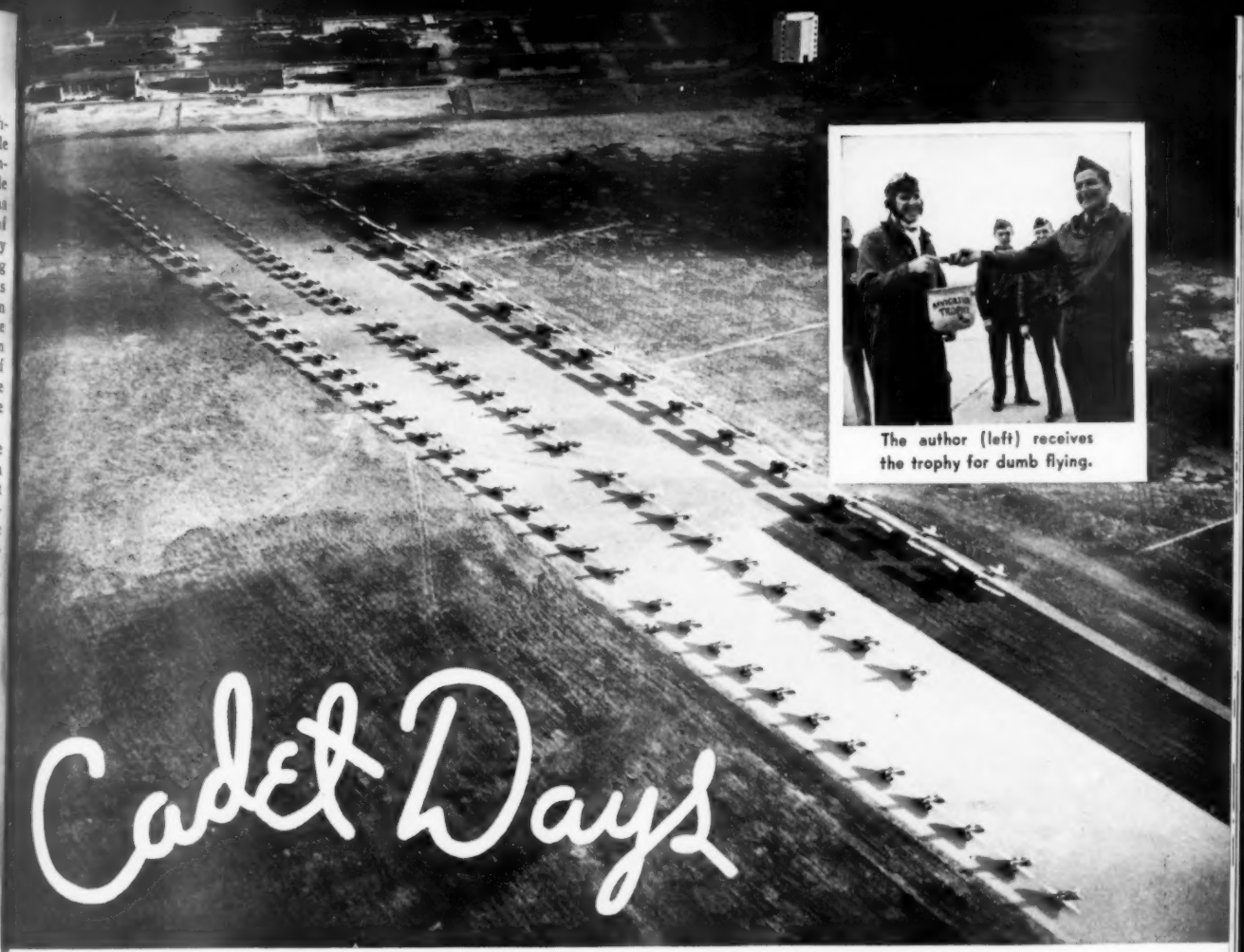
When an airplane is flying blind there is always a possibility that it may be a menace to other planes in flight on that route, especially those headed in an opposite direction. Generally, when we are practicing blind flight at our home airdromes, we do it in two-seaters and a safety pilot rides behind who can look out ahead. If there be an approaching plane he warns the pilot inside the covered front cockpit to turn, using the interphone for communication. Naturally I could not cruise the national airways without a safety pilot. There was no place for one in the plane. We licked that situation by having another pursuit plane of the same type fly formation—slightly above and to the rear of my plane, so that he could serve as the lookout for other craft in flight. Each plane was equipped with a two-way radio so that the safety pilot in the plane behind could transmit any warning.

The radio was an invaluable aid to us as it has been continually to all airline flying. It not only told us where we were by the radio beam, but through it we could hear the weather broadcasts ahead, and with it we could hold conversations as though we sat at either end of a telephone; in fact, it was a radio telephone.

The business of selecting a flyer to accompany me, fly formation on my plane all the way, and serve as safety pilot, was not a chance affair. Every flying man thinks, usually quite rightly, that his safety aloft is dependent upon his flying judgment as well as his flying skill. The former is probably the more material factor. Thus the judgment of the man I selected for safety pilot became the ticket for my safe transport across the continent. I must exchange my flying judgment for his. I gave more thought to that selection than to any other one factor surrounding the expedition. I finally asked Major William E. Kepner, Air Corps, if he would accompany me on the flight. He accepted with alacrity.

Bill Kepner has not been in the military flying game as long as some. He was a doughboy in 1918 at Chateau Thierry when the Germans shot a hole through his jaw and stuck a bayonet through his face. But he refused to die. When the war was over he decided that the chances for adventure were better "upstairs," so he transferred to the lighter-than-air section of the Army Air Corps. Thus he became a "balloonitic"

(*Continued on page 69*)



Cadet Days

The author (left) receives the trophy for dumb flying.

AT KELLY FIELD

by MacDONALD H. HAYS

Here are the author's final flight training days before his recent appointment as an Army officer.

IT'S been said before and will be said again I suppose but I'm going to put in my two bits worth to the effect that the old P-12 is the doggonedest, most surprising airplane that Boeing or anybody else ever made.

The first take-off I made in one was a miracle. The plane jackrabbited off the ground and seemed to me to be flying in all directions at once. The bank and turn indicator had gone completely insane and the needle and ball swapped sides every time I touched the rudder.

As soon as I collected my wits enough to notice, I saw that the altimeter hand was practically spinning like a top and Kelly Field was just postage-stamp size down below. There was just God and I in that airplane. God had taken it off and climbed to 10,000 feet—I took over from there.

The difference between a P-12 and any other airplane I have ever flown is that it responds *right now* to the slightest touch on stick or rudder. You practically "think" it around a turn.

When I decided to come down I pushed the stick forward and before you could say Popocatapetl I was going 250 miles per hour and the altimeter was unwinding as if it were spring driven. I made a pretty good landing, and my first flight in a P-12 was over. It may not be the greatest thrill I'll ever have, but it's right up in there.

The P-12 is the smallest plane and the Keystone bomber the largest here at Kelly.

Above is a "taxpayers' show" at Kelly. Cadets show off their school here.

By the end of the first week I was flying them both. These two airplanes present a remarkable contrast. The one is light sensitive responsive—the other is six tons of assorted lumber and definitely has a mind of its own, especially when taxying. Steering the ship on the ground with the motors instead of the rudder and brakes causes the beginner no end of trouble.

In the air, it is fairly easy to fly and anyone who has a strong back and a weak mind can herd it around successfully. All joking aside, everybody has a sneaking fondness for the old clunks. If you can imagine sitting out on your front porch and flying your house around you will get a notion of what they're like to fly, and the average man gets a thrill out of looking out and reflecting that he is in sole control of all that tremendous

Both pilots and ground crew had to "rescue" this bogged-down Seversky.

mass of wires and spars and telephone poles and stuff.

But our business here at Kelly isn't just learning to fly different airplanes and, incredible as it may seem—even when we leave here there may possibly be some things connected with flying that we don't know yet. In fact, a rude old gentleman once said that it wasn't quite as hard to teach Kelly graduates how to fly as those persons without any previous training, but it was pretty near as hard.

For one thing, we had to start radio beam flying from scratch, but nobody took it very seriously until one night the attackers ran into some soup on a cross-country. About fifteen minutes on instruments on a nasty night will make a Christian out of anybody, so it was not surprising when the entire class got down to business and took their beam flying seriously.

The tough part of radio beam flying is staying on the beam. If you have a cross wind you sit under the hood and sweat and wonder why you keep getting an "N" signal instead of the steady buzz through the headphones which indicates the "on-course" signal. So you kick a little right rudder and in a couple of minutes you find you have wandered across the beam and are getting an "A" signal.

Of course, most of our practice beam flying is done within five or ten miles of KCAW, the station we use, and the beam may be only 40 or 50 feet wide and harder to stay on than it would be at a distance of 100 miles—where it may be several miles wide.

Systems of orientation of the beam look very pretty on paper but when under the hood—and somewhat slightly lost, many an embarrassed student has suddenly had the hood pop open and looking out has discovered he was headed for El Paso—some 550 miles away. The system we use here is called the Kelly Field System. It is made up of equal parts of the "fade-out paralleled" and "90 degree" methods, and when mixed well and served with a dash of hope—makes quite a mouthful for the average cadet.

The Air Corps is taking instrument flying more seriously now than in the past. In fact, it is considered so important that a cadet is given about 30 hours the first year.

Increasingly important, too, is the old stand-by—formation. We in pursuit are particularly lucky in this, because we are getting a chance to practice some new formations that are being worked out to meet the rapidly changing problems of pursuit tactics. The pea-shooters have to be better formation flyers now than ever before to tackle these new bombers and they also have to have types of formations that allow whole squadrons to maneuver with practically the freedom and ease of a single ship.

No account of flying at Kelly Field would be complete without telling of that grand old pursuit section custom, the "rat race." If you'll hang on to your hat, I'll explain what I'm talking about.

We've been flying formation for about

(*Concluded on page 97*)

The New Wendt W-1

Though it is an exceptionally well streamlined ship for its class, the Wendt is comparatively low priced. For added leg room, the ship has overhead controls.

AMONG the latest of the new airplanes to be announced is the experimental Wendt W-1 shown above. This ship, the product of the Wendt Aircraft company of North Tonowanda, N. Y., is to be known as the *Falconer*. Not having yet received its Approved Type Certificate, the *Falconer* is classified as experimental.

Powered with a 90 h.p. Warner engine, Robert Wendt claims his design is capable of a maximum speed of 140 m.p.h., cruising speed of 125 m.p.h. and a landing speed of 38 m.p.h. Capable of climbing 1,000 f.p.m., the *Falconer* is said to have a service ceiling of 16,000 ft. and 600 miles range.

Low initial cost and economical operation and upkeep is the goal of the Wendt design. If and when the *Falconer* is placed on the market the price, according to Mr. Wendt, will be below $3,000.

Bendix Direction Finder

AMONG the interesting and advanced developments by the Bendix Aviation Corporation is a two-way radio equipment in power from 10 watts to 100 watts. This provides multi-crystal controlled operation and remote electrical quick-shift to any frequency desired, all incorporating extremely lightweight design.

Left-right indicating radio direction finders provide absolute assurance against 180° ambiguity and are so designed that if anything fails in the equipment itself, no course error will occur.

Advanced designs of aural-null direction finders were shown recently, all with rotatable type loops and controlled mechanically and hydraulically at remote positions from the pilot's cockpit.

These devices include the most modern and advanced engineering design and provide a means for "homing" to destination on any radio signal within certain frequency limits or the obtaining of bearings or actual "fixes", if required.

The Bendix direction finder is shown below on display at a recent air show.

FAIREY RAIDER

This swift light bomber is the newest in Britain's sweeping air rearmament program.

Personalities

Pilot Dick Merrill (right) co-piloted at the recent wedding of Pilot Jack Lambie to the former Miss Mary Maverick.

Air-minded King George of England shows great interest in his Royal Air Force, likes to chat informally with pilots.

Actor Reginald Denny advocates radio-controlled gas models like the big one beside him for anti-aircraft practice. Price: $600.

Foolproof airplanes and speed flying are not all that occupy Frank Hawks. Above is a scene from an air movie starring him.

Lieut.-Col. Robert Olds led the Army's recent Argentine flight of six bombers and 49 men.

Pan American Airman Max Weber, age 29, has flown the Pacific 40 times.

Lieut.-Col. James Roosevelt, USMC, flew to Cuba for annual tour of duty.

Vincent Schmidt of New York is reported to be flying against Japan.

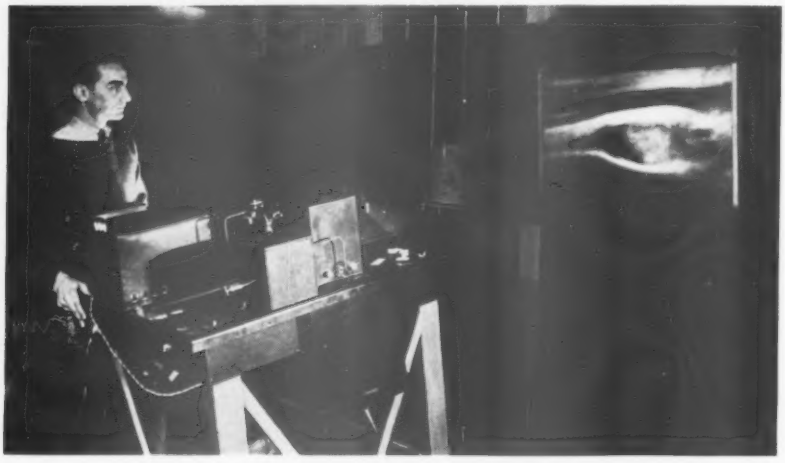
Pilot Bob Buck tried for days to fly east to wed Jean Pearsall, finally took a train.

Eighty-year-old R. W. R. Capes, the "oldest commercial photographer," took his first flight recently. He covered the World's Fair of '93. *Kaufmann-Fabry Photo*

Ocean-flyer John Polando (New York to Turkey in 1931) today divides his time between a Massachusetts flying service and another business.

Glenn L. Martin tells a Congressional committee of a super-plane with 11,000 miles range.

New Wind Tunnel at School



The Boeing school's new wind tunnel device is shown projecting an airflow chart.

A NEW smoke flow wind tunnel has been established at the Boeing School of Aeronautics for use in visual instruction.

This tunnel is complete in every respect. The throat or test section of the smoke tunnel is made of glass to make the airflow phenomena visible, while a 250-watt metal filament lantern lamp is used in conjunction with efficient lenses to project the model being tested upon a large screen. A method of generating kerosine vapor and releasing it from a single orifice upstream from the model was developed after many experiments.

The separation of the air flow into a higher speed stream above the airfoil section, a lower speed air stream below the airfoil section, and a region of stagnation centrally are all points of interest in explaining airflow.

The very turbulent wake behind the airfoil section demonstrates a breakdown of the air flow due to an excessive angle of attack. However, other smoke flow patterns are obtained with the section when it is placed at various angles of attack.

A complete series of related models and standard geometric forms are available for the several demonstrations that are a part of the course of instruction at the school.

Bellanca's Latest

AMONG the newest airplanes on the American market is the recently announced Bellanca *Junior* shown below. This is the first time Bellanca, long a builder of high-priced custom built aircraft, has made a bid for the more popular market. This ship's first appearance (at the Chicago air show) drew many an interested comment from the public and the industry alike.

Two models will be offered. They will be identical, with the exception of optional power—either a 70 or a 90 h.p. Le Blond. Also optional will be a retractable landing gear. Standard equipment, though, will be the 70 h.p. engine and fixed oleo landing gear. According to Bellanca officials, this standard model will sell for $3,150 flyaway New Castle, Del.

The *Junior* is a three-place full cantilever low-wing monoplane, has a capacity of 22 gallons of fuel, cruises 500 miles at 110 m.p.h. Top speed is 130.

The Bellanca "Junior" can be had either with or without retractable landing gear.

Pilot-Passenger

SEVERAL months ago Jack Knight, famed holder of the 2,400,000 mile record of having flown more miles than any other pilot, retired from active flying to become director of public education for United Air Lines. At that time he said that twenty solid years of flying was enough and he looked forward to a job "flying a desk".

But, on one of his frequent coast-to-coast trips in the passenger cabin, Knight figured up that he has been flying even more since he left the job of line pilot than he did while flying on schedule. Formerly he was limited to 85 hours in the air each month but now he is averaging over 100 hours flying per month as a passenger. Knight still retains his license.

In his new work Knight visits every one of the thirty-seven cities on the company's New York-Chicago-Pacific Coast and Seattle-San Diego airways.

Brooms, combs, tea, cocoa, slippers fly swatters and soap may not spell air transportation to the average person, but they are just a few of the hundreds of articles with which every airliner is equipped.

Air Travel Up

REVENUE passenger miles flown by the airlines of the United States during January, amounting to 27,110,800, were higher than for any previous initial month of any year, according to Colonel Edgar S. Gorrell, president of the Air Transport Association of America.

This favorable passenger traffic trend, 50.5 percent over January of 1937, when 18,006,557 revenue passenger miles were flown, Colonel Gorrell attributed in part to newspaper advertising and the manner in which newspapers throughout the country covered by news articles and editorials the new low air line trip insurance rate of 25 cents for $5,000. This is the same as the trip insurance rate for surface travel.

The January 1938 figure is 4.4 percent over the December 1937 figure of 25,967,833 revenue passenger miles. Usually, during the Christmas season, and in the interim between Christmas and New Year's all travel is heavy and last December was no exception.

It is believed that, due to the favorable weather during the first nine days of January, there were more seats filled on the airlines than during any other nine consecutive days of any winter or even late fall or early spring month.

Indicative of the increased public acceptance of air travel is the fact that the January total of revenue passenger miles flown was in excess of the same factor for all months of 1935 with the exception of July, August and September. January's figure was but 430,000 revenue passenger miles less than September of 1935.

THE YANKS IN SPAIN

by FREDERIC B. ACOSTA

The Spanish war drew many American flyers-of-fortune. Most of them, though, returned disillusioned to the United States.

AT the beginning of the civil strife in Spain, flyers were in great demand. The field offered a temptation to red-blooded, young and adventurous American pilots. Soon after the Spanish rebellion started, the first influx of United States citizens began to trickle into Spain; to both sides, the government and the insurgent.

After a year and a half of this struggle, there is no clear, complete and authentic account in this country that tells of the active participation of American aviators and volunteers serving with the Loyalist side and with the insurgents. This prompted the writer to make a thorough investigation and survey on the matter, and in the following are detailed some human angles and interesting information that throws light on the actual participation of our boys in the Spanish war.

Spain at the outset of the war was the least of Europe's air powers. She had only some 150 planes. When the rebellion broke out many army officers flew some of the ships to the rebel camp, while the remaining planes in the airdromes in Madrid were either wrecked or sabotaged by rebel sympathizers. But soon after that every class and make of the latest and best European military planes was engaged in the war.

The first squadron of 25 American flyers, headed by Captain William B. White, filed into the headquarters of the insurgents and enlisted in the aviation branch, and this whole squadron represented the first Spanish insurgent air force. They flew and fought daily, not against the Spanish as Captain White said, but against the crack flyers of France and England who had enlisted with the government.

Upon their arrival in Spain, Captain White and his men were given 10 bombers and 15 pursuit planes. The American commander believed that with this fighting air force at that time the revolution would be over within 24 hours and subdue the Loyalists. But Captain White did not reckon with the superior Russian warplanes and Russian airmanship which constitute the nucleus of the Spanish government air forces.

Insurgent General Franco seemed to have shared Captain White's idea, for Franco believed at the outset of the war that within two weeks he would capture Madrid. But 17 months have passed and General Franco's forces are not yet within the gates of Madrid.

Captain White and his men enlisted with Franco's forces for two reasons; the lure of good pay ($1,000 in gold for each flyer) and the spirit of adventure. They were red-blooded fighting men and they craved action.

Now let us take a look at the American pilots enlisted and serving with the Spanish Loyalist air force.

When the civil war started, there were a number of American people in sympathy with Republican Spain. This sympathy found expression in certain prosperous New York business men and professional people who hated to see Spain conquered by Italian and German armies and planes.

They took the shortest way through the red tape. They contributed money for the first batch of aviators, for which the Spanish government wired its thanks and appreciation, and money to finance new squadrons from America.

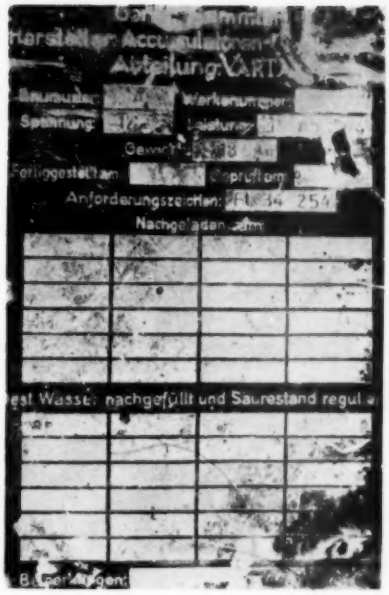
This first contingent included such experienced air men as Major Frederick A. Lord of New York, former member of the Royal Flying Corps and a World War ace; Bert Acosta, Capt. Gordon Berry, Edward Schneider, Ed. L. Semons, and the "flying reporter," Ben Leider.

Captain White and his squadron flying for the Spanish insurgents and Major Lord and his men for Spanish government offered a grim reality of Americans fighting against Americans in the current Spanish revolution!

In a recent conversation with one of the American aviators who has just returned to the States from Spain, told the following:

> "My fellow American flyers went to Spain to fight for the Republican Spain. We hated to see a nation of 25,000,000 people conquered by foreign fascist invasion."

The U. S. flyers enlisted with the Spanish government were all superior in training and experience as airmen, some saw service as aces during the World War and some as noted test and racing pilots. And each of them had at least 3,000 hours actual flying. The Spanish government paid $1,500 per month in gold to each flyer, plus $1,000 gold bonus for each plane shot down.



This plate from a wrecked warplane in Spain proves the Germans are in it.

The first batch of American aviators serving with the Loyalist side flew under almost impossible conditions. The Russian aviators flew their own Russian-made ships, which were better built for war purposes. They were swift and maneuverable. The French also flew and fought in their own planes. But the American pilots who would rather have fought in American-made planes could not do so because there were none in the Spanish government forces because of embargo enforced by the U. S. government.

These valiant Americans were given a motley collection of airplanes of all speeds, some were old commercial planes outfitted with bomb-racks, and some were not even equipped with machine-guns.

The audacity and fighting quality of the early American squadron had won the praise and appreciation of the Spanish military officials. And as early as September of 1936, the American flyers had proved their worth in checking the first air attack of Madrid by General Franco's Italian aviators.

The most enthusiastic of this bunch was Ben Leider, who for two years was a "flying reporter" for the New York *Post*, and when the civil war began in Spain he offered his services as an aviator to the Spanish government without pay. Ben Leider's enthusiasm was such that he was accredited with the enlistment of other American aviators. Ben Leider's pal, "Scotty" Nelson, who has fought in most of the wars since 1914, was one of the earliest American pilots with the Loyalist air force. Nelson happened to be in Spain on a visit when the insurrection started.

The most spectacular adventure of all the American flyers was that of Harold E. Dahl, an Illinois flyer, and his capture

(*Concluded on page 92*)

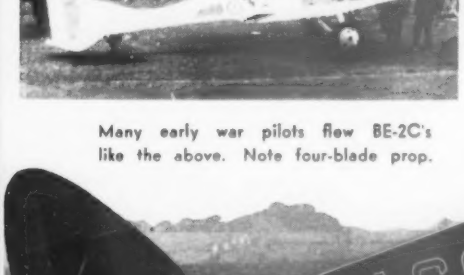
The Story of

by GORDON SEAR WILLIAMS

Latest DH is this four-engined high speed "Albatross" now being tested.

The name De Havilland is synonymous with aviation wherever you go. This very much alive British manufacturer is a colorful legend that will fill an important niche in aeronautical histories of the future.

This is DH-1. It carried two persons and was powered with an 80 h.p. motor.



Many early war pilots flew BE-2C's like the above. Note four-blade prop.

One of King Edward VIII's (Duke of Windsor) personal airplanes was this twin-engined "Dragon" transport.

de Havilland

IN the World of aviation there is probably no more famous name than that of the British manufacturer, de Havilland. Wherever air travel has reached de Havilland airplanes will be found hard at work, and air forces all over the globe use these popular ships for varied duties. This universal use of de Havilland aircraft is really not so strange or startling when we consider the fact that Captain Geoffrey de Havilland has been actively engaged in designing aircraft since 1908, when with F. T. Hearle (now general manager of the de Havilland company), he designed, built, and flew his first biplane. Due to the success of this ship de Havilland joined the Royal Aircraft Factory at Farnborough, which is now famous as the testing ground of new and experimental planes for the Air Ministry. It was while at Farnborough that Captain de Havilland evolved the now famous "B. E." series. A rather interesting note was introduced at this time. These ships had been named "B. E." to stand for "Bleriot Experimental," to distinguish them for the "F. E.'s," or "Farman Experimentals," which had tractor propellers. As these titles brought no end of censure on the British aircraft trade a rather weak attempt was made to justify the names as "British Experimental," for "B. E.", and "Fighter Experimental" for "F. E.". Captain de Havilland also helped design the popular SE-5's, among the most famous of wartime single seaters.

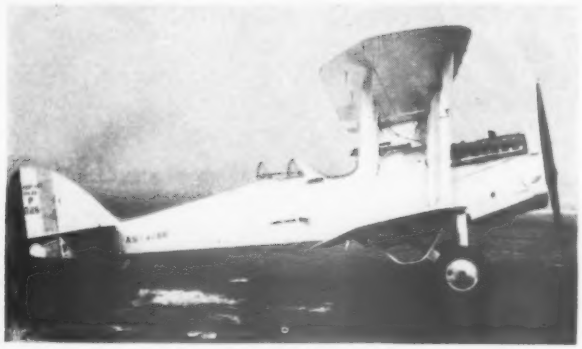
Shortly after the outbreak of the World War Captain de Havilland joined the Aircraft Manufacturing Company as chief designer. He had been here but a short time when he was called to service with his squadron in France, but after serving for a very short time was hustled back to England to lend his valuable talents to the aircraft production scheme. The DH-1 pusher-fighter, out of which were evolved the first "B. E.'s," was actually made before the War. The next ship, the DH-2, was in most respects like the DH-1 but used a 100 horsepower rotary engine in place of the watercooled 80 h. p. Renault. Considerable numbers of the DH-2's were used in the Somme offensive and they were, on the whole, quite successful. Soon after the DH-3 appeared, a twin-engined bomber with folding wings, and having extension shafts to the propellers to avoid interference with the wings. It was later redesignated as a DH-3A and used more powerful engines.

The most famous military airplane of all time next made its appearance, the DH-4. As far as is known there were more DH-4's built for military service than any other single type of war machine. They were used by practically every country who had even the merest semblance of an air force. The Army Air Service of the United States used the sturdy old DH-4's as standard observation-attack-bombers for many years, and as well used them in the early pioneering flights of the Air Mail service. Various engines were mounted in these ships, the most famous being the Rolls-Royce "Eagle," B. H. P., 240 h. p. R. A. F., Liberty 12, Lorraine, Hisso and others.

The DH-5 was notable for its "Beechcraftlike" appearance. Its back-staggered wings enabled the pilot to sit well forward and gave him an excellent view for fighting. A rotary motor was mounted. Although these single seaters were used in considerable numbers during the War, they were not particularly liked by pilots in general, and gained the name of being "difficult" ships.

The famed "Clutching Hand," the DH-6, came into the picture next. This trainer was used by many of our wartime heroes in early flying-schools. It gained the above nickname because of its known unstable characteristics. However, one point was in its favor, if a

Above is a squadron of "Gypsy Moth" trainers of the Australian air force. That "Fox Moth" trainers are popular is proved by this scene at the factory.



This is the DH made famous in the United States just after the War. A large number of these ships flew the U. S. mail.

As a wartime one-place fighter, this odd-looking DH-5 saw only a little service. A rotary engine powered this model.

Comparable to the old Boeing 40-B-4 is the DH-50. The pilot sat "outdoors" while passengers had the small cabin.

Another version of the DH-50 was this DH-61 "Giant Moth" powered with an American Pratt & Whitney "Hornet" engine.

This is the world-famed "Gypsy Moth". G-AALG once was the property of Britain's former king (now the Duke of Windsor).

Not very chummy for the pilot, this "Fox Moth" was none-the-less a popular sport plane. Notice the small cabin.

The "Hawk Moth" was the British counterpart of our early Stinson or Travel Air. The engine is a 240 h.p. "Lynx".

Canadian operators find this DH-89 an excellent design for feeder and off-line airline flying as well as freight.

pilot could successfully manage a "Clutching Hand" he could fly 'most anything. A 90 h.p. R. A. F. or an 80 Renault were standard power units.

The next two designs, DH-7 and DH-8, were not completed. The former was to have been a fast single place fighter with a Rolls-Royce *Falcon* engine. The DH-8 was a pusher design for a big forward-firing gun.

The DH-9 was the logical development of the successful DH-4 and was in most respects like its forerunner. It first appeared powered with a B. H. P. engine, but later the Siddeley *Puma* was standardized. Some were equipped with 230 h.p. Fiats and at a later date Napier *Lions* were installed. This ship proved to be so popular that for a time more than 250 per week were being rushed through Britain's factories. The modified and improved DH-9A was for many years used as the standard Army cooperation two seater of the Royal Air Force. These later ships used either the Rolls-Royce *Eagle* or Liberty 12 engines.

The DH-10 was Captain de Havilland's second twin-engined design and was powered with two *Puma* engines. A DH-10A also was built, differing from the original in having the engines mounted directly on the lower wings. Another twin motor was built, the DH-11, which used two *Dragonfly* engines and was supposed to be a fighter-bomber. It proved to be a "Jonah" however, due to engine trouble. The DH-12 was merely a modification of this type and had a slightly different gunner's cockpit.

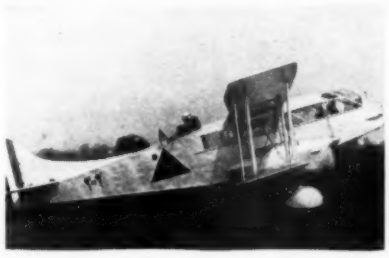
The DH-13 number was not used.

An experimental DH-14 was flown with a Rolls-Royce *Condor* engine, and was a rather large single-engined biplane. It was not produced for service use.

An experimental higher powered version of the DH-9 became the DH-15. It was a very fast ship for its time, and powered with a Siddeley *Atlantic* engine, did better than 140 m. p. h. The DH-16 was a further modification of the DH-9 and mounted either a Rolls *Eagle* or a Napier *Lion*. Four passengers could be accommodated in the cabin, in much the manner of the old Boeing 40-B-4's. One of these ships was used to test early "wing flap air brakes." The next in order, the DH-17, would have been one of the sensations of the age. It was almost completed when the Armistice was signed and the aircraft industry in general suffered a dismal slump. Two Rolls-Royce *Condor* engines were mounted and 16 passengers were accommodated in the large cabin. And, most remarkable of all, a retractable landing gear was incorporated in the design. This amazing ship was designed before 1920!

De Havilland designed his first purely commercial ship soon after, as the decline in military buying following the War showed in no uncertain manner that manufacturers must look to "greener pastures" if they were to stay in business. The DH-18 really marked the turning point in de Havilland design, most ships from this time on being of purely commercial types. The DH-18 was an eight-passenger

Four-engined airliners are not new to the British. This DeHavilland (DH-86B) has been in airline use for some time. It is powered with four 200 h.p. engines.



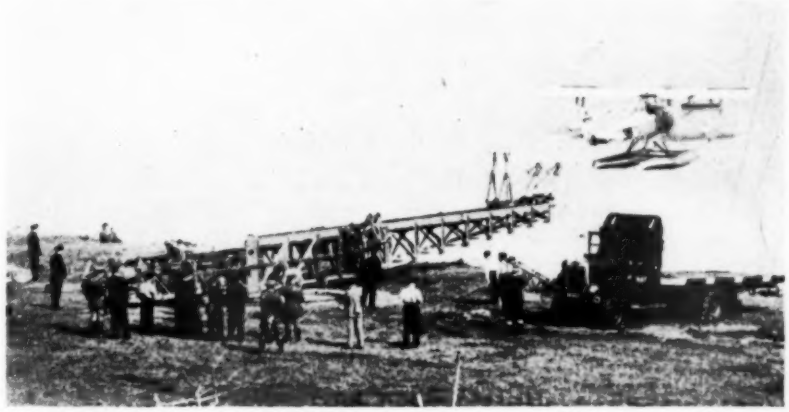
This DH "Dragon" was a special job built for the army air force of Iraq.

"Dragon-Rapide" light transports are popular as military and civil craft.

The "Puss Moth" is one of the most popular British cabin sport planes.

The "Tiger-Moth" is a popular two-place trainer with an 130 h.p. engine.

One of the most interesting modern aircraft is the "Queen Bee" radio-controlled target ship. Pilotless, it is catapulted, flown to altitude, then shot down.



cabin plane and used a Napier *Lion* engine.

The DH-19, 20, 21, 22, 23, 24 and 25 were all designs which were not completed. They ranged in type from a multi-motored job with but one propeller to a small four passenger flying boat. Due to generally poor post war conditions these ships did not progress beyond the primary stages.

In 1920 the de Havilland Aircraft Company Limited was formed and as its first ship turned out the DH-26, a high wing, cantilever monoplane having a 1,000 *pound* payload. Two were built to Air Ministry contract under the designation DH-29, and were arranged to carry 10 passengers. The DH-27 was an experimental bomber for the government which was not proceeded with.

During this time a considerable business was being transacted in selling and rebuilding surplus wartime aircraft of all types. Many of these rebuilt ships were sold abroad. The de Havilland School of Flying was also opened.

The numbers 28 through 31 were all "ghost ships" and did not get beyond the drawing board stage of development. The DH-33 was likewise a "ghost" and was to have been a shipplane.

The DH-34 was extensively used by various airlines in England and on the continent. It was an eight-place Napier-powered biplane.

De Havilland's numbering 35, 36, 38, 39, 40 and 41 were all observation planes designed for the Air Ministry and various foreign governments. None was built. The DH-37 was one of the first private owner types, and used a Rolls-Royce *Falcon* engine. It seated two people and was built to private order.

The DH-42 was an observation two-seater built to Air Ministry specifications and used a Siddeley *Jaguar* engine. The DH-56 was later developed from this design. A Bristol-powered DH-42A and an all metal DH-42B also were built.

In 1923 the need became apparent for larger, speedier transports and to this end various layouts were made by de Havillands along these lines. Numbers 43 through 47 were all multi-engined schemes.

Layouts were completed at this time for the DH-48, a survey ship for Canada to mount a Wolseley *Viper* engine. It was, however, not proceeded with. The DH-49 was also a "ghost" and was to be a general purpose biplane with a Rolls-Royce engine.

DH-50's are still being used in some of the more out of the way parts of the world, particularly in New Guinea and Australia. A four-passenger cabin biplane, it can mount any radial engine of about 500 horsepower. Sir Alan Cobham used a ship of this type on his memorable flight to India to chart the Imperial Airways route.

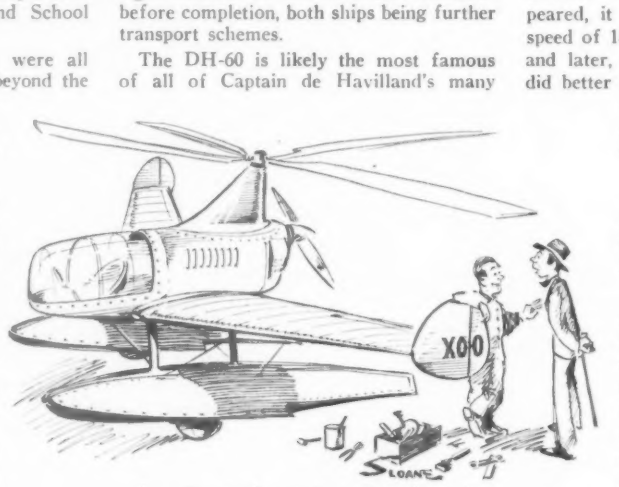
The DH-51 was a type on the general order of our popular Wacos and Travel Airs of a few years ago. It was a two-three seater with a water-cooled 90 h.p. R. A. F. engine. A DH-51A, using full span wing flaps, was also built. (The DH-52 was a glider built for the Itford Meet of 1922.)

The DH-53 may be regarded as the first "flivver" plane in the de Havilland series. Some of these little low-wing single-seaters are still in use and we recently read of some excellent flights being made with one in Australia.

The DH-54, known as the *Highclere*, was a 14-passenger Rolls-Royce cabin job designed for over-water flying. It featured a dropable landing gear and watertight cabin. Wing flaps were used on both wings.

The DH-55 and 57 were both trimotored transport types, using, respectively, *Airdisco* and *Puma* engines. Neither design was completed. Likewise, the designs number 58 and 59 were "scuttled" before completion, both ships being further transport schemes.

The DH-60 is likely the most famous of all of Captain de Havilland's many creations. This is the justly popular *Gypsy Moth 60*, of which something over 3,000 have been made, and which was the first practicable private owner lightplane. As originally produced, the DH-60 used a Cirrus engine of 80 h.p., and was of all-wood construction. Later *Moths*, of the 60-G and 60-M types, used *Gypsy* engines and were of metal tubing construction. Folding wings, wing slots and easy handling are some of the famous features of the *Moth*. Many of these ships have been made in the United States and other countries who acquired license rights from de Havilland.



"... it sort of came to me in a dream."

The DH-61 is in many ways similar to the DH-50 but carries a larger load; eight-passengers, and mounts either a Bristol *Jupiter or* Pratt & Whitney *Hornet* engine. Skiis, wheels or floats can be used.

The numbers from 62 through 64 were designs for transports which were not proceeded with.

The *Hound*, or DH-65, held the world's record for speed over a 500 and 1,000 km. course carrying a 1,000 kg. load. The *Hound* used a Napier *Lion* engine and among other innovations had all metal spars. A modified type, the DH-65A, was built for the Australian government.

The DH-66 was the famed *Hercules* type, long used by Imperial Airways for European service. Three Bristol *Jupiter* engines were mounted and heralded the day of air cooling for larger transport types.

DH-67 was a survey type for the Aircraft Operating Company, Ltd., and was finally completed by Gloster Aircraft. The DH-68 was an Army cooperation type for Australia and was not completed. The 69 was a high-performance supercharged day bomber. The DH-70 *Executive* was merely a drawing board design for a twin-engined cabin job. The DH-72 was this company's first venture into pure and simple racing design and was most successful. Benny Howard's little low powered racer of a few years back, the "Pete" is in many ways similar to the DH-71. In 1927, when the DH-71 appeared, it averaged the almost incredible speed of 185 m.p.h. over a marked course, and later, after considerable cleaning-up, did better than 197 in level flight. These speeds were accomplished using a four-cylinder 90 h.p. *Gypsy* engine.

The DH-72 was built as a military version of the *Hercules* and mounted the center engine over the wing. Only the one ship was built.

The 73 and 74 both were twin-engined survey and transport designs which did not materialize. The DH-75 *Hawk Moth*, although a recent ship, is not very well known. It was actually the forerunner of the popular *Puss Moth 80* and *Leopard Moth*, but was a somewhat larger ship than either of these two, having either a Siddeley *Lynx* or a Wright *Whirlwind* for power. It seated six passengers and could be used on wheels, skiis or floats with equal facility.

The DH-76, 78 and 79 were all multi-motored transport designs which were not developed.

The DH-77 was De Havilland's first and only venture into modern high speed fighter design. It was a wire-braced low wing job, in many respects similar to the DH-71. It used a 24-cylinder Napier *Rapier* engine, and was used for experimental work only.

The DH-80 is the well known *Puss Moth*, many of which are still in world-wide use. Folding wings and car-like comfort were the main features of these trim little monoplanes. Construction was of mixed type. The fuselage was of welded steel tubing and wings had wooden spars and ribs and fabric covering.

The private owner loomed large in the aviation picture from this date on, and the de Havilland company took notice of this in designing its ships. The DH-81 was a two-place experimental cantilever monoplane with a DH 75 h.p. engine. It was not too successful, and after modification

(*Concluded on page 70*)

AERO MUSEUM

by J. B. ROBERTS

Aviation history now is preserved in a permanent museum, due largely to the efforts of the WPA. There is no more appropriate site than Dayton.

RELICS pertaining to aviation and models and exhibits depicting the thrilling history of American flying are being preserved at the U. S. Army Aeronautical Museum at Wright Field near Dayton, Ohio—the home of the Wright brothers.

Wright Field is the experimental field of the U. S. Army Air Corps. Every ship purchased by the Army is first tested at this field.

Workers employed by the Works Progress Administration are building models of planes in which American aces made aviation history, display cabinets, airport models and are editing and filing hundreds of thousands of feet of motion picture film of early Air Corps history.

The WPA workers also are preparing about 100 types of airplane motors for exhibition at the Museum, at the 1939 World's Fair and at other places throughout the nation.

Visitors to the U. S. Army Aeronautical Museum—only one of its kind in the nation—are able to trace the history of American aviation from the first daring flights of the Wright brothers in their gliders to the latest super-speed scout planes.

On either side of the entrance to the Museum stand pedestals made by WPA workers supporting busts of Wilbur and Orville Wright, the fathers of aviation.

To digress for the moment, it seems unfortunate that the original Wright plane, in which the first flights were made, is reposing in the British Museum instead of being included in the fine display in our own museum, but such are the sad facts in the case. It is to be hoped that, in the course of time, the original Wright plane will be returned to Dayton—and home.

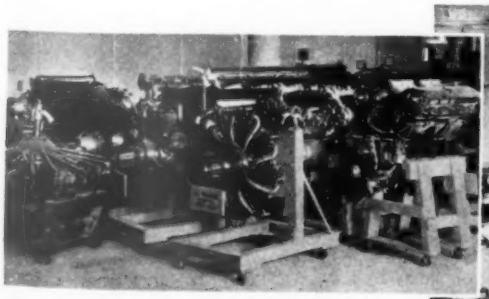
In the accompanying photographs will be seen a few of the historical pieces already installed in this museum. For example, in the lower right hand corner of the large picture will be seen one of the original Wright engines enclosed within its glass case. Just above it is a case containing one of the famed wartime Liberty engines that made mechanical history in its time. And then, in the center of this view is an old DH which was equally famous, both as a military ship and as one of the first planes to fly the U. S. mail.

It is entirely fitting that this museum is devoted to the activities of the Air Corps and its progenitors, the U. S. Signal Corps and the U. S. Air Service. The Air Corps has been intimately associated with all aeronautical developments throughout the history of aviation and every development, either commercial or military, is at least reflected in the practice of the U. S. Air Corps. Everything from the famed record breaking soaring glider at the Hawaiian Station to the four-engined *Flying Fortresses* of recent date, has been included in the activities of this outstanding service.

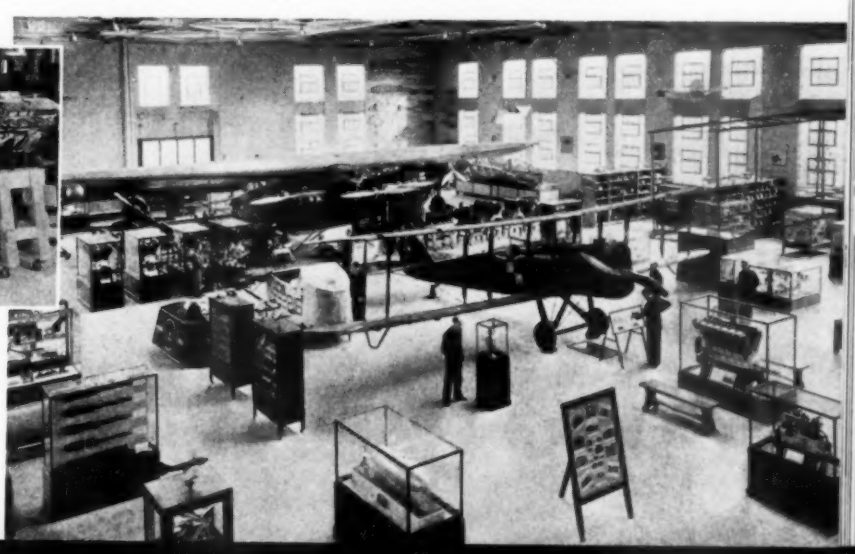
Other museums, including the Smithsonian Institute, have been actively collecting aviation relics throughout the country, that cover the activities of independent experimenters and commercial planes and it is well that this work is progressing rapidly under pressure as these old relics are rapidly depreciating in the haymows and cellars where they are stored. The U. S. Army Aeronautical Museum in taking care of the military division of aviation now makes a complete record available to posterity and is to be applauded as a final and lasting tribute to a great American inventor.

Museums of this sort are not simply records of the past, in a historical sense, but are real reference libraries for engineers and inventors of a later date. They bring to light many little refinements and gadgets that have proved more or less successful in days gone past and which are well worthy of being revived. A few hours spent in an industrial museum is inspiring and suggestive to the studious engineer as will be testified by the many old relics being revived on present day planes such as nose-wheels, skids and similar devices originated many years ago.

This bust of Orville Wright stands in the lobby of the new air museum.



Some of the world's most famous aviation engines have been gathered and displayed.



Looking down into the museum proper. In the foreground stands an early DH mail plane.

These are some of the members of the Los Angeles County Sheriff's Aero Squadron. Capt. Claude F. Morgan, commander of the group, is sixth from the right.

Flying Cops

by JAMES FARBER

Even the police departments are flying these days. Which would tend to end that old belief that you can outrun a cop.

SIX pairs of eyes spotted the sluggish tugboat almost simultaneously as it moped along through the waters of Long Island Sound. The eyes belonged to five New York policemen and their pilot, a fellow officer. Aboard that tug rode a man wanted for homicide.

It was 12 hours after the crime. The detective bureau had received a tip. "Your man is skipper of the tug, *Vincent A.*, and he's gone up the Sound." After two hours of low flying, almost skimming the water at times, the flying cops had spotted the vessel. But they had no radio with which to summon the skipper to heave to. Nor had they insignia on the wings of their fleet amphibian.

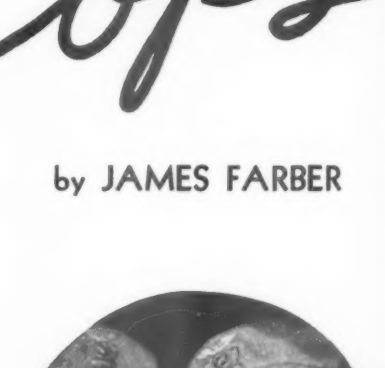
Those were the early days of aerial cops. So, reluctantly, the boys gave up the chase and put about. But only for a few hours. They notified Deputy Chief Inspector Edward P. Mulrooney (later Police Commissioner). "We'll get him," Mulrooney snapped. Nearly a day later, with Mulrooney aboard, the amphibian slid along the placid waters of the Cape Cod Canal, revved around, and effectively blocked the progress of the *Vincent A.*

The officers boarded the craft. The amazed skipper read the inexorable purpose of the law in the cold grey eyes of Mulrooney. In his cabin, he agreed to the detective's suggestion that he waive extradition and return to New York to face the music.

Thus occurred the first capture of a criminal in the history of aerial police in the United States. That happened in 1930. Since then, the war against crime has taken to the air and the thrills and chills of aerial combat with winged criminals, the heroic exploits of flying guardians of the law in rescuing distressed persons at sea and on land—by plane—and the monumental police problems solved by the airplane have written a chapter second to none in the annals of the gripping parade of contemporary events.

Consider, for a moment, the duties of a flying police squadron. Its members are expected to prevent kidnappings, preserve the peace, protect lives and property, prevent crimes, detect and apprehend law violators, chase thieves, gangsters, smugglers and lamsters, follow pigeons through the air, step into the breach in case of air accidents, spot trouble, locate all kinds of fires and make rescues on land and sea.

To do these things, some of which overlap and include one another, of course, these flying watchdogs are equipped with light and heavy aircraft, radio facilities, rescue apparatus, and the sinister arsenals of deadly combat including machines guns, rifles, revolvers, hand grenades, aerial and gas bombs.

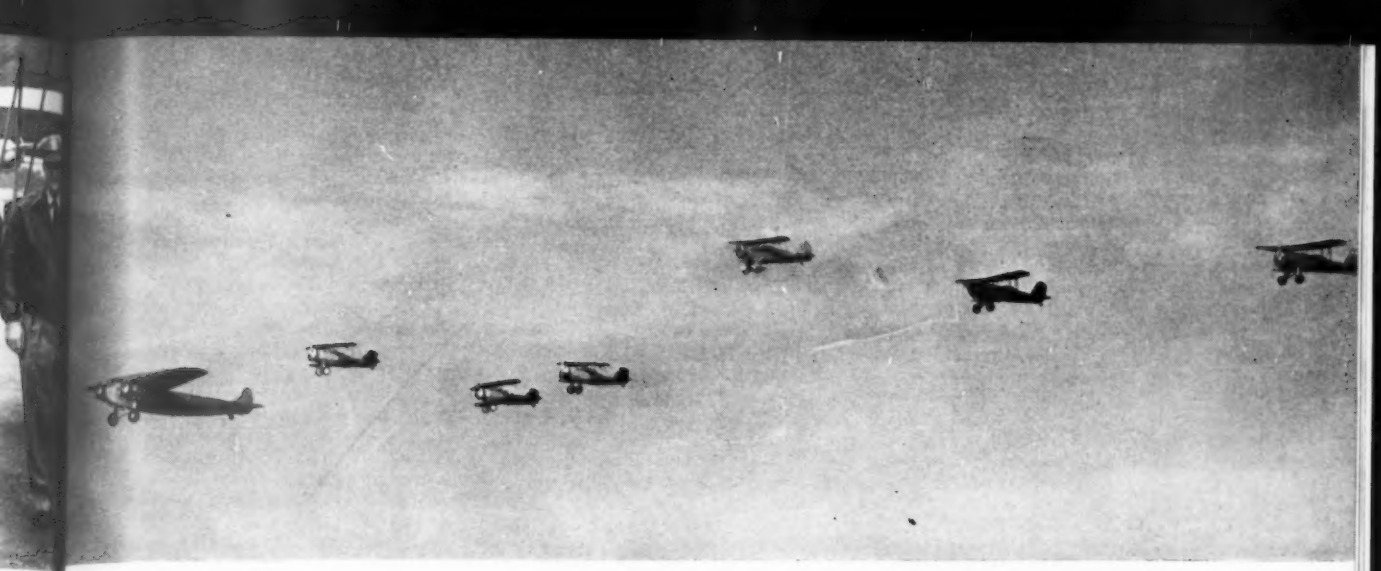


Sheriff Biscailuz (right) and Jimmy James of the Los Angeles air police.

It takes a very nervy guy indeed and a very efficient one, to make the grade as a flying cop.

Although the United States is just beginning to learn the importance, to say nothing of the practical uses of aircraft in police work, the day is dawning in which the airplane will come into its own as an indispensable auxiliary.

Today, the best equipped, hardest flying, largest and most complete aerial police force in the world is the sheriff's aero



One of the three ships at the right in this picture probably is a police plane covering the "special" flight.

squadron of Los Angeles, California. The New York Police Department's squadron, handicapped by hectic politics and turbulent municipal finance, ranks next in the country in point of size, equipment and personnel. Use of the airplane by other police departments is limited but it is definitely progressing. But of these—more later on.

The nation's first squadron of flying cops was born less than 10 years ago in Bergen County, New Jersey, when three thousand people gathered at good old Teterboro Airport to witness Bergen County Police Chief Peter J. Siccardi launch the project. It was June, 1929. Major Clyde Pangborn, Captain Hugh Wells and Lieuts. Walter Jones and Leon Allen were in charge.

The Wright Aeronautical Corp. presented the squadron with a nice new Fokker. The department had acquired three Standards and the ceremonies went off with a bang. From then on, the heavy traffic of Bergen County was under vigilant direction from the air while scores of khaki-clad motorcycle cops unsnarled it on the ground.

New York, always airminded but often slow on the trigger, next got under way. The energetic police commissioner, Grover Whalen, hatched his plans a few months later. In March, 1930, the unit went on duty for the first time. It was equipped with two land planes and two amphibians—without radio—and its personnel numbered four men, each of whom had pounded the beat in uniform before being taught to fly!

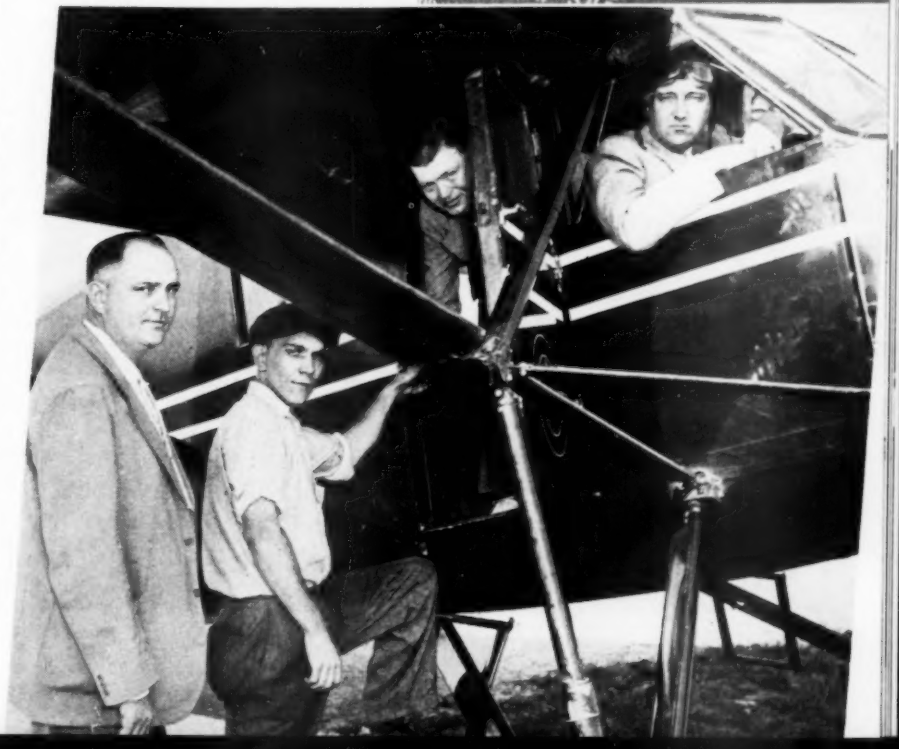
A long series of aerial accidents in New York City and environs had taught the city a lesson and led to the formation of the unit. Action was quick in coming. During the first week a seaplane fell into Long Island Sound. Out went the flying cops. Pilot and passengers were pulled out of a choppy sea which was battering the plane to pieces. How the cops ever got away with it only they can say.

The next week a reckless pilot was scaring the daylights out of a crowd gathered in Van Cortland Park, north of Manhattan. Flying cops zoomed on him, forced him to land, and arrested him. The boys had hardly finished talking about this during their ground flying sessions when an emergency call came in sending them out to pick up a drowning man in the East River. They got him, alright, by arriving on the scene within eight minutes of receiving the alarm.

By November of the same year, the Aviation Bureau of the Emergency Service Division, as it is still called, had so proved its value that two-way radio communication equipment was purchased to keep men posted at the aviation base and at Headquarters on Centre Street.

Meanwhile, the flying cops were besieged with calls and there was very little money to appropriate for extra personnel and equipment. The detective di-

Capt. Claude F. Morgan, Los Angeles air police chief, also is an Army man.



This aerial police squad is about to fly a suspect (in shirt) to trial.

vision was on the trail of a million-dollar bootleg ring. Daily, the boys of the flying division trailed pigeons through the murky skies above towering skyscrapers and daily returned half blind. But the breaks finally came. The right pigeon was found and she homed to a spot in the Catskills. Police spotted the ring's center of operations and made wholesale arrests.

A wealthy citizen of Brooklyn was threatened with kidnap and murder. The canny criminals chose pigeons to carry messages. They demanded $2,500. The citizen told police. Pilot Otto Kafka (about whom more later), said he'd "show these crooks a thing or two" as the result of some strenuous personal experiences.

He painted the "go-between" pigeon orange color and followed it from a skyscraper. The bird went to a Jamaica, Long Island, dovecote. When the owner showed up he was nabbed. The gang was traced through him and laid away for the rest of their lives in Sing Sing. They were fourth offenders.

At just about the same time, a gang of extortionists sent a pigeon to a prominent Monrovia, California, citizen demanding that he send them ten $1,000-bills. A flying cop traced the bird to a widely known fancier who identified its purchasers. They were criminals with long records.

But, meanwhile, between saving people from drowning, arresting reckless pilots, chasing crooks and following pigeons, the New York cops acquired two additional planes and some extra personnel—each new member being taken from the 18,000 of the city's finest. Scope of the work was enlarged to include traffic control.

Early in 1932, police controlled a hundred thousand automobiles congesting traffic in Manhattan during a monster civic parade. Sky traffic cops in the blimp *Resolute* hovering over the Big Town did their stuff, issuing orders to a score of radio cars and motorcycles on the ground.

Inevitable in the New York scheme of things is politics.

Came the upheaval.

Arthur N. Chamberlin, who organized the aerial service, resigned in 1934, Commissioner John F. O'Ryan (World War major general who commanded "O'Ryan's Roughnecks," the New York A.E.F. division), recommended drastic cuts in police aerial activities and personnel.

Airminded Mayor LaGuardia hotly defended the use of planes. O'Ryan came out with a sweeping plan to militarize the department and proposed complete abolition of the aerial unit. Beleagured, LaGuardia compromised. Two planes were sold for $310 each. They had cost the city $7,000 apiece. They went to an automobile dealer who used one as an advertisement and the other for a cruise to the West Indies.

Today, Commissioner Valentine's first deputy commissioner, Yaleman Harold Fowler, heads the aerial division. He served in the World War, became an air service colonel, was shot down seven times and wounded four, received the D.S.M. and one time in a spirit of fun flew his plane under the Arc de Triomphe, Paris. He is in constant touch with Deputy Inspector Arthur Wallander, the department's emergency chief, and studies the city's traffic problems from blimps and planes.

Since most people are poor judges of how high planes are flying, the New York pilots are swamped with complaints of low flying which they duly investigate and usually find erroneous. The boys operate from 8 a. m. to midnight, in two shifts. There are four pilots, four mechanics and two planes.

It is interesting to note that thus far the city has been unable to recognize the extra hazards attached to the work of these flying cops and their pay is the same as they received while they patrolled their beats, dreaming, possibly, of the day they might be called for flying training.

There are 1,000 applications on hand from members of the uniformed and detective divisions. Each applicant has at least qualified for the two basic requirements: to be a police officer and a good swimmer. Groups of these men attend classes conducted by their flying comrades. They know "the day will come"—sometime.

The afternoon patrol at 5 o'clock is the highlight of the day for the New Yorkers. At this hour millions of men and women are swelling all traffic arteries as they go home. More fires and accidents and emergencies occur about this time of the day than at any other. The bay and rivers are filled with liners, ferryboats and a thousand miscellaneous craft. Scows break away from towboats. If a watercraft leaves no wake, the police pilot must swoop down and have a look-see. Nine out of ten times the vessel is in distress and is without radio to summon help.

Most spectacular job of the department was the heroic rescue of the survivors of the crash of the Navy dirigible Akron, in 1933. The U. S. Navy blimp J-3, seven aboard, crashed while assisting in the search for men still afloat. Pilots Kafka and John W. Forsythe, handling a police plane, landed in a rough sea. Three cylinders went dead as spray lashed the billowing craft. Five Navy men were taken aboard; the other two had drowned. The flying cops made makeshift repairs, got back to their base. The story made every front page in the country. Kafka and Forsythe were cited by the department and in addition received medals and a scroll from the International League of Aviators.

And now let's roar across the country to Los Angeles which put itself on the aerial police map in a big way about the time the merry men of Manhattan were beginning to learn what it was all about.

Alert, dynamic Sheriff Eugene W. Biscailuz assumed office in 1933. Intensely airminded, he recognized the urgent need for a highly trained aerial division. The county didn't have the money. What to do about it? Well, he had friends. Many of them were pilots. He called on them. Would they organize themselves and serve as volunteers?

Well, now, WOULD they . . . indeed! They jumped at the chance. They came in such numbers—and still are—that the reserve list is today larger than will probably ever be needed short of an armed invasion by national enemies.

The sheriff's aero squadron of Los Angeles, as this crack outfit is officially known, was formally and legally inducted into existence in June, 1933, by county ordinance. Every member owns and operates his own equipment and is a duly appointed deputy sheriff who serves without compensation.

Los Angeles County has an area of 4,009 square miles, an 80-mile coast line, is one of the most densely populated areas in the nation, and leads in aircraft manufacturing. It is close enough to the Mexican border to be within the theater of operations of smugglers, gun runners

(*Continued on page* 86)

The Army does air-policing on its own hook. Here a Curtiss "Falcon" is shown flying convoy to government cars carrying a payroll to Wright Field, Dayton, O.

LOOK OUT BELOW!

This diving Hawker "Hind" would strike terror to a British foe in time of war. In peacetime, though, this menacing maneuver makes a beautiful portrait.

the NATIONAL AIR BOARD Says...

Dr. Alexander Klemin, Chairman

ON its 22nd meeting, the Air Board had the pleasure of entertaining J. C. Franklin, communications engineer of TWA (to whom the $250 safety prize had been awarded at the last meeting) and of presenting him with a fine commemorative plaque. Modest and generous Mr. Franklin has thought fit to share the award equally with Peter H. Redpath, navigation engineer and Howard K. Morgan, radio engineer of TWA. Another welcome guest was J. Barton Underwood, organizer of the highly successful aviation balls, held annually in New York City.

The Lockheed Accident

Readers will remember the recent accident to the Lockheed "14," on Northwest Airlines, when rudder and fins broke off, with disastrous results. The question before the Board was: Though the Lockheed held an Airworthiness Certificate of the Department of Commerce, was the value of such a certificate from a safety point of view somewhat doubtful?

Not at all, was the consensus of opinion. The rudders and elevators of the Lockheed were balanced neither statically nor aerodynamically. The periods of vibration of the vertical and horizontal tail assemblies were rather slow, which is always dangerous since slow periods may mean resonance with the eddies coming off from the wing. The Dutch transport company, K. L. M., buying similar machines insisted on static and dynamic balancing before acceptance. Therefore neither the Lockheed Aircraft Company nor the Department of Commerce were covered with glory in neglecting a precautionary measure which all students of vibration advocate, and they will know better in future. But an error of judgment, however serious, does not invalidate the whole system of airworthiness determination.

Messrs. Quick and Wilford emphasized the value of one innovation which has resulted from the accident. Hitherto proving tests of airliners have been made in good weather. But the Lockheeds were grounded and given a proof test of 50 hours of all kinds of weather, good and bad, before again receiving license. *Proving that tests in bad weather are an essential to safety.*

Escape from Over-Regulation

The Board was informed on very good authority that the legislation establishing a permanent Federal Aviation Commission was almost certain to go through and welcomed the establishment of a new regulatory body.

Our readers may be astounded that a new regulatory body was actually welcomed by intelligent men in these days with over-regulation in almost everything that affects the life of the nation. But the situation in aviation is peculiar. The industry, particularly the transport section of the industry enjoys the attention of three Governmental agencies, the Interstate Commerce Commission, the Bureau of Air Commerce and the Post Office. A tripartite rule is almost intolerable. Experimental engineers on the airlines, a most devoted and most enthusiastic body of men, are actually slowing down in their experimental work because the process of obtaining approval of every nut, bolt or electric switch is so lengthy. The Post Office provides only 30 per cent of the airlines revenues, the other 70 per cent coming from passenger and express traffic, yet insists on schedules which suit the carrying of the mails but do not suit passengers at all. The I. C. C. has much to say about rates, public conveniences, etc., and regards the other two government departments with some degree of jealousy.

It would actually be a boon to the industry were regulation centered in one agency which would take in the safety, rates and scheduling work of all the three existing agencies.

But the personnel of the proposed Federal Aviation Commission is all important. This personnel should not be composed solely of lawyers or of politicians, even of respectable politicians. It should include at least some men with knowledge of aviation.

The Board voted the following resolution unanimously.

The establishment of a Federal Aviation Commission to centralize in one body the present tripartite control of the industry is highly desirable, provided that at least three of the five Commissioners are men of standing and experience in aviation, and if possible experienced flyers.

Dump Valves

Readers will remember that the Board has previously discussed the question of gasoline dump valves and their prohibition by the Department of Commerce. The new dump valves, recently authorized seem to be very much better.

In the discussion Mr. Franklin gave it as his opinion that the possibility of lightning or other electrical discharge igniting the gasoline was too remote to be seriously considered. The danger with dump valves is the possibility of gasoline vapor permeating vulnerable parts of the airplane and leading to fire and then explosion.

This is precisely the danger which the new dump valves, so Mr. Quick told members, will eliminate. The new valves lead into long, narrow pipes, of streamline form with narrow exit section. The gasoline will be carried well below the wing or fuselage. The narrow section will mean a jet discharge of real velocity so that the gasoline pours out in a coherent mass of fluid and *not* in vapor form. With the former short pipes of wide cross-section, when the Lockheed company made experiments with perfumed fluids, the whole ship smelled like a congested nightclub for days.

It was the feeling of the meeting that even if the new valves made dumping somewhat slower than before, a real hazard has been removed by their design.

Funds for Naval Experimentation

The House Naval Affairs Committee has decided upon $15,000,000 for experimentation by the Navy, the appropriation to cover new types of surface vessels; new types of airplanes; and $3,000,000 for a new airship half the size of the *Macon* or the *Akron*, to be used solely for training and experimentation.

Mr. Wilford thought that the appropriation of such sums for experimentation was ridiculously small. As much money might well be spent on experimental construction as on production aircraft.

Allocation of the $3,000,000 for an airship was approved though not too warmly. Perhaps this time the Navy will know how to handle the craft so as to learn worthwhile lessons without a final disaster to mar a year or two of good work.

Planes are Too Clever!

Dick Depew has as a rule views on aircraft matters that are full of common sense, and his comments on the bomber flight to the Argentine were no exception to this rule. Our bombers get so large they cannot use the majority of our airports, and would find no place to operate from in warfare. Our fighting ships are so clever and so full of gadgets that they require pilots of superhuman skill to operate them.

If we are to be ready for defense in the air, said Captain Depew, let us have plenty of relatively simple, rugged airplanes, not too large so as to be white elephants, and not so complicated that they cannot be operated by military pilots of average skill.

These views met with the heartiest approval.

A Meaty Subject for the Next Meeting

For discussion at the next meeting there was allotted to members for study a series of closely related topics:

1. The tricycle landing gear and its effect on airport and landing fields.
2. The difficulties of smaller municipalities who find that the huge airliners make their airports obsolete.
3. The necessity of keeping up airports for private flyers, even when they no longer serve the airliners.

Members were warned, under no penalties whatsoever, that they would be required to make a serious study of these topics for the next meeting.

END

Soaring Flight of Sea Birds

by RAOUL J. HOFFMAN

A condensed compendium on bird flight theory together with original observations by the author. Study of the birds reveals many important facts.

A GREAT deal has been written on bird flight, especially on flapping motion of wings. This oscillatory motion with its three-fold utilitarian characteristics of elevating, supporting and moving forward the bird presents a problem so intricate that up to date, not sufficient laboratory tests are available to verify any hypothesis.

However, tests conducted on ornithopter models (some were built 200 years ago) show that the same lift is obtained at about 70 per cent of the speed of propeller driven models, but that the thrust is twice the amount required for standard models. Sec. 1 shows the varying position a flapping wing will have relative to the line of flight and relative to a fulcrum point.

Rubber-driven ornithopter models have obtained a duration of five minutes; nevertheless, it is a long way to man-carrying machines, which will meet the problem of the time of oscillation and the moment of inertia of the flapping wing.

Simpler and of greater interest to the student of aeronautics is the motionless, powerless flight; the soaring of birds. After a detour of building very efficient power driven airplanes, soaring machines have been built that reach a degree of development equal to the performances of soaring birds. Surprisingly the general outline of the bird and that of the soaring machine becomes more and more alike.

Numerous theories, however, have been advanced to clarify the soaring ability of birds, such as the hot-air-in-the-bones, the weight-and-feather, the free-lever-of-nature, the pulsating-wing-surface and the air-sacs theories, elaborately but wrongly presented.

Nevertheless, there are three theories that are accepted to interpret the soarability of birds: the rising air current, the pulsating wind speed, and the oscillating wind direction. The rising air current, may it be obtained by the natural tendency of heated air (thermals) or by the vertical component of wind blowing over hills or past obstacles, is the only one proven by the amazing performances of soaring machines. Added instruments and new designs may utilize the rest of the innate energy of the moving mass of air. Sketches in Sec. 1, Sec. 2, Sec. 3 and Sec. 4 show some of the items connected with soaring problems.

The utilization of the rising air current (1891) by soaring birds and soaring machines is only possible if their sinking speed is lower than the vertical component of the surrounding air. The sinking speed is the vertical descent relative to the ground.

From an aeronautical standpoint, the sinking speed will depend on the wing loading, the aspect ratio of the wing and the cross-section of the wing. Accompanying table shows data of a few soaring birds.

To find the soarability of birds, dead birds and models of birds were placed in wind tunnel; the best gliding angle thus found was only 4. to 4.5; but actual observation showed that the gliding angle is better than 1 to 15. This result was obtained by using a kite of known characteristics and measuring the tension, the length and the angle of the cord. The best gliding angle of soaring machines is close to the one observed on soaring birds. Contrary to the results it is claimed that the best gliding

A sea gull slowing its speed with back-swept wings and heavy dihedral.

And this is how a pelican slows its flight on a sweeping turn.

A frightened pelican puts on the brakes and stalls before the camera.

This pelican is in a fully stalled position with zero forward speed.

And here we have a pelican gliding to a landing with negative dihedral and flexed wing tips. The wings are compressing air against the water.

angle of birds will be found to be 1 to 100.

The gliding angle is in close relation to the aspect ratio of the wing. The aspect ratio is the ratio of span and average chord. The higher the aspect ratio the better the soarability; thus sea birds have higher aspect ratio than land birds. But the estimation of aspect ratio may be erroneous on birds having spread tip feathers. The albatross has the highest aspect ratio and it can outsoar any other bird; the turkey vulture (buzzard) soars only at low altitude to locate its food, has a low aspect ratio; soaring steadily on small diameter circles it acquired a very pronounced dihedral of its wings. Sec. 5 and Sec. 6 show the outline of a few soaring birds.

Another influencing factor is the wing loading, the weight per square foot wing area. This loading will determine the gliding speed but will not affect materially the gliding angle. The greater the velocity of the wind the higher must be the wing loading in order to advance against the wind. It is self-evident that land soarers will have lighter wing loading than sea birds that have to stay aloft during storms. The albatross with its three lbs. per sq. ft. naturally cannot take off as easily as the buzzard with one lb. per sq. ft. wing area. Buzzards, as observed, require only a height of one foot to start soaring on a hot day. The albatross, it is claimed, stays in the air for *six months*, only to swoop down to the surface of the sea to catch its food.

The camber of the wing—especially the camber of the lower surface—is another influencing factor to soarability; it will depend on the wing loading and therefore directly proportional to the speed of the bird. The albatross has less camber on the lower surface of its wings than the vulture. The camber must be measured with the right wing loading, the same loading they have in the air, the same pressure and the same suction. This negligence was often the outcome of sketches showing the lower surface having double cambers. (Sec. 8.)

The rising air current, as mentioned above, is the only accepted reason for soaring. Birds utilize this deflected air current over ships, close to piers and close to waves. Soaring machine pilots naturally must be versed with meteorology to be able to glide from one rising air current to another. The rising air current is assumedly not present at high altitudes, over seas; therefore the soaring birds must have another source of energy.

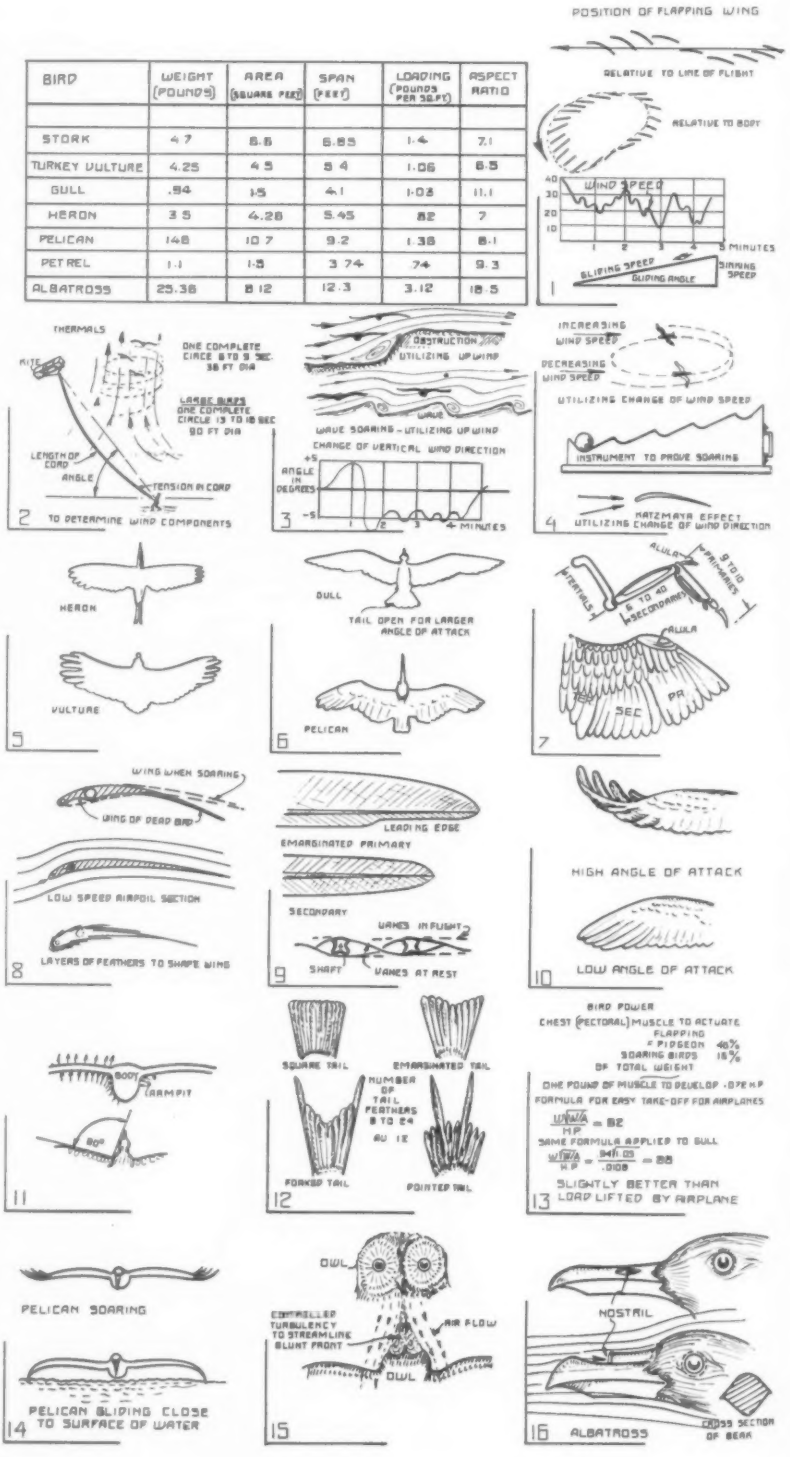
To utilize the energy of the pulsating wind for soaring, the bird is supposed to glide with increasing wind speed up wind and with decreasing wind speed down wind. Sec. 1 shows a diagram of change in wind speed that does not indicate any rhythmic variation, therefore, circling flight cannot explain this theory. But, the flexibility of the lower surface of the wing may adjust itself to the varying conditions and may derive some lifting power from the changing wind speed. An instrument, shown in Sec. 1 is used in explaining the possibility of soaring in pulsating wind current; placing a ball at the lower end and moving the instrument back and forth the ball may be made to climb up hill.

Closely related to above-mentioned theory is the theory advanced of deriving soaring power from oscillating wind direction. It is often called "Katzmayer effect." It has some scientific value if the moment of inertia of the bird is accepted to be equivalent to a fixed point. However, the adaptability of the camber of the lower surface to the small ripples and fluctuations of the air current would explain the lift obtained for soaring.

A bird wing and especially its feathers is the most amazing unit nature has

(*Continued on page* 88)

BIRD	WEIGHT (POUNDS)	AREA (SQUARE FEET)	SPAN (FEET)	LOADING (POUNDS PER SQ.FT)	ASPECT RATIO
STORK	4.7	8.8	6.85	1.4	7.1
TURKEY VULTURE	4.25	4.5	5.4	1.06	6.5
GULL	.94	.5	4.1	1.03	11.1
HERON	3.5	4.28	5.45	.82	7
PELICAN	14.8	10.7	9.2	1.38	8.1
PETREL	1.1	1.5	3.74	.74	9.3
ALBATROSS	25.36	8.12	12.3	3.12	18.5



A Letter From FRED NOONAN

to Lieut.-Comm.

P. V. H. WEEMS

Lieutenant-Commander Weems was a personal friend of the late Fred Noonan. It was at the Weems navigation school that Noonan gained much of the knowledge that later was to be responsible for the many colorful trans-oceanic flights in which he participated.

THE navigation of scheduled trans-ocean aircraft is accomplished with the assurance and accuracy approaching that of ocean liners. The large clipper planes have roomy and fully equipped navigation compartments and full use is made of all available methods for safe navigation. Many of the skilled navigators were formerly licensed marine navigators and are permitted to use their own preferred methods and equipment.

With the two-fold purpose of giving a valuable technical description of the navigation as accomplished on a clipper plane, and also as a tribute to the navigator of the Earhart plane, the following confidential letter is published with the knowledge of Pan American Airways.

While this letter is a personal one, and while different navigators will obviously use different details in accomplishing their work, I believe the data prepared by Fred Noonan gives as clear an idea of what is actually done aboard trans-oceanic planes as any brief account given to date.

"Hotel Claremont
Berkeley, California
May 11, 1935

Lieutenant Commander P. V. H. Weems
United States Navy, Retired
Annapolis, Maryland

Dear Commander Weems:

I hope you will pardon this long delay in acknowledging your congratulatory and greatly appreciated letter of April 1. Preparatory work prior to the flight to Hawaii, and subsequent arrangement and study of data gathered during the flight, has so occupied my time that I am afraid all my friends consider me an extremely poor correspondent.

"For reasons which I am certain you will understand, we are not permitted to discuss the particulars of the flight for dissemination among the general public. However, there can be no objection to an informal discussion that will not pass beyond the second party. Having long considered you the foremost authority on the subject of aerial navigation, and appreciating the interest you naturally would have in the Hawaiian flight of the *Pan American Clipper*, I am exercising that privilege.

"Due to the spacious chart room and large chart table aboard the Clipper the navigation equipment need not be so severely limited as in smaller planes, hence the choice of equipment may be governed entirely by the individual's personal preference or the company's desires in the matter. To date the company has not decided upon any standard equipment, and therefore I chose the equipment used on the subject flight. My choice was not necessarily based upon a conviction that the particular type of any instrument chosen was superior to any other type. As a matter of fact, several factors influenced the selection. Pre-eminent among them was the fact that most of the instruments had been used extensively by the writer and had proven satisfactory; in some instances a choice was governed entirely by the nature of the work involved—as for instance, parallel rulers versus protractors—and I suspect that plain prejudice, which actuates so many of us, carried some weight.

"A set of marine charts, general, coastwise, and harbor, was carried; also aviation strip charts of the California coast. The actual chart work was carried out on VP-3 and 4 Aircraft Plotting Sheets. By working along the track from Alameda to the left hand border of the chart, then transferring that termination of the track back to the right hand border in the same latitude, and continuing in this manner, two sheets sufficed for the entire crossing.

"Time pieces carried were a Longines Civil Time chronometer, and a Longines second-setting watch. The latter was set to correct G.C.T. at all times by checking with the chronometer. This watch was of the arm type, but the strap was removed, and the watch clips on the octant were adjusted to accommodate the beckets on each side of the watch. I prefer such arrangement to carrying the watch on the arm.

"Two sextants were carried—a pioneer bubble octant, and a mariner's sextant. The former was used for all sights; the latter carried as a 'preventer.'

"Originally a Pioneer Universal protractor was installed on the chart table but experience convinced me that parallel rulers, where room permits their use, are more satisfactory for rapid plotting of long range D.F. bearings because of their greater scope. Protractors, such as yours, are more convenient for plotting short bearings and lines of position. However, a minimum of instruments lessens confusion, so I decided upon the rulers only. Those carried were of the Captain Fields Improved type—graduated in degrees—and consequently the greatest objection to their use in aircraft; namely, creeping, when referring to compass roses, was removed.

Amelia Earhart and Fred Noonan, photographed just before their last flight.

"I also carried a Dalton Mark VII Navigational Computer, which I find a great convenience.

"The actual navigation was comparable with such as would be practiced afloat—fixes were determined entirely by stellar observations at night. These fixes were more reliable than would be possible by crossing a line of position with a D.F. bearing, due to the amount of error which would be introduced by even a small angular error in the long range D.F. bearings. By day, having only the single heavenly body for determination of lines of position, we did cross the bearings. However, during daylight hours we were nearer the radio stations and consequently the error in-

troduced was generally considerably reduced.

"The accuracy of fixes was very gratifying. By that, an accuracy of approximately ten miles is implied. My experience is that such a degree of accuracy is about the average one may expect in aerial navigation. A comparison of our expected time of arrival over Kaneohe Bay, Oahu, where our D.F. station is located, and the time of our actual landfall affords a good indication of the reliability of our sights. At 0457 L.C.T., while still above a solid cumulus bank, our fix by Polaris and Deneb was latitude 24° 04'N, longitude 153° 14'W. That was our last observation, and on the strength of it we advised our station we would pass over at 0700. We were then cruising at reduced speed so as to arrive at Pearl Harbor not earlier than 0800. Going below the clouds shortly after establishing the fix, we encountered light mist and scattered showers. The visibility varied between two to 12 miles, which prevented us sighting Molakai, as we would have done with normal visibility. At 0653 we sighted Makapuu Point slightly on our port bow, with Kaneohe Bay directly ahead. At 0700 we were directly off the radio station. This accuracy was due to smooth flying conditions at the time of sight, and of course it could not be cited as an example of accuracy consistently possible.

"The greatest difficulty is, of course, the determination of drift angle. We carried smoke bombs and water flares for this purpose. The latter are of an improved pattern and are unusually effective when the surface of the water is visible. However, during both flights —westbound and eastbound—we were above solid cumulus banks approximately 90 per cent of the time. The smoke bombs are not entirely satisfactory. Although a special pattern has been developed, we find that the smoke blends too closely with the water color to afford a good reference mark.

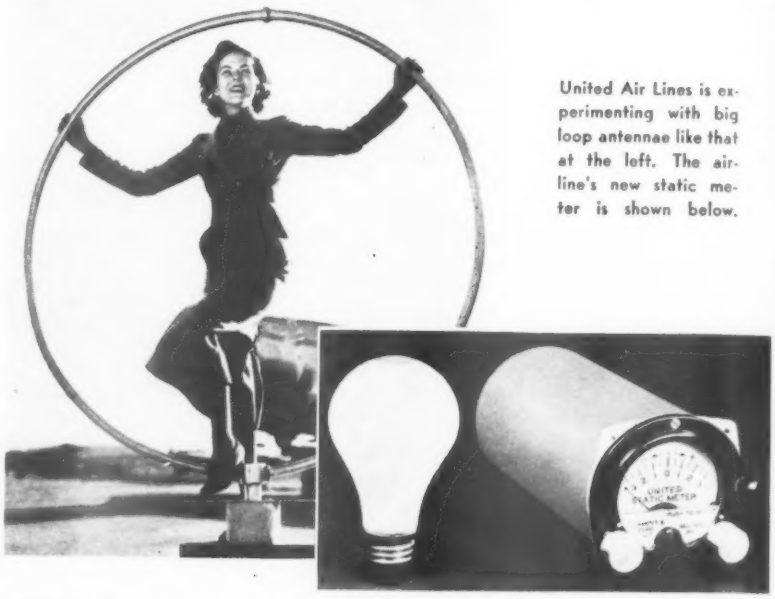
"Consequently, the difference between 'no wind' positions and fixes established by observations were utilized entirely for determination of drift angle, and, of course, wind direction and velocity for laying new courses. This method proved to have been quite accurate, as indicated by the very nearly direct track we made for the entire westbound flight. However, it would not be so desirable in a region where sudden wind shifts could be expected. Then reliance would necessarily have to be placed on D.F. bearings despite their lack of extreme accuracy.

"In addition to the actual navigation, I maintained a very detailed log during both flights. In addition to recording courses, variation, deviation, track made good, indicated and true air speeds, ground speed, etc., a complete meteorological record was kept. As you may imagine, each hour represented 60 very busy minutes.

"I consider the development of the Greenwich Hour Angle idea the greatest contribution to the science of navigation since Sumner, and have used it exclu-

(*Concluded on page* 88)

New Static Detector



United Air Lines is experimenting with big loop antennae like that at the left. The airline's new static meter is shown below.

STILL fighting to eliminate the dreaded rain and snow static so common to airline operations, United Air Lines engineers have perfected the above anti-static ground loop and a static "detective", whose size is emphasized above by the standard electric light bulb.

The tubular hoop is five feet in diameter, and now is being tested in an effort to eliminate static from ground station reception of plane-to-ground signals. The static detector, now being tested on two airliners, records positive or negative charges of static and measures their intensity.

Stainless Steel in the Army

THE installation of a stainless steel wing at the Material Division, Wright Field, Ohio, on an Observation Amphibian (OA-4A) airplane during the latter part of 1937 was the culmination of an experimental program in connection with this construction extending back well over five years, says the Air Corps News Letter.

It has long been realized that from the maintenance standpoint the wood wings of the OA-4A were inadequate. Joints loosened under high humidity conditions and in other respects they were a weak feature on what was otherwise acknowladged to be a rugged and serviceable aircraft.

When the suitability of a metal wing was considered, it was known that duralumin, with its high corrosion characteristics in sea air or water, could not be used. It was decided to try stainless steel.

The first step was the submerging of specimens in tide water for testing over a period of time. No corrosion either in material or around spot welds resulted. A stainless steel wing was constructed and submitted to static testing at the Material Division.

At the conclusion of these tests it was exposed to the elements at Wright Field for more than two years without noticeable deterioration. As a result of the static tests, some parts of the wing had top be reinforced.

A thorough testing under vibratory loads simulating those in flight followed. No failure occurred either in the thin sheet or the spot welds.

With this basis of encouragement, contracts for a total of seven stainless steel wings were entered into with Fleetwings, Inc. The purpose was to mount them on OA-4A airplanes for service testing. Two are now at Langley Field, one will go to Panama, one to Hamilton Field, one to Mitchel Field, and the others elsewhere to coastal squadrons.

The steel wing is lighter than the wood wing, based on the same design load factors and same gross weight of the airplane. The actual weight of the steel wing is 4 pounds greater than the wood wing it replaced, but the steel wing was designed for a 50 percent greater low angle of attack load factor and a 20 percent greater inverted flight load factor than the wood wing.

It has a very smooth external surface, the spot welding allowing slight speed advantages. It requires no finish or paint, which is a weight saving and maintenance advantage.

A "Tricycle" Forced Landing

by D. W. WHITING

An interesting incident with a three-wheeler.

AN airplane is an airplane until someone smacks the earth with it, but a Stearman-Hammond is an airplane no matter what you do with it. . . .

During the second week of November, 1937, Eastern Pennsylvania was having one of those "never-say-die" rains. It had been raining for three days and the ground was thoroughly soaked. On the afternoon of November 13, the rain had stopped, but there was a heavy fog with ceiling zero. Air traffic was almost at a standstill.

That evening, about seven o'clock, things began to happen and didn't lose any time about it.

Al Schachterle, chief pilot at Main Line airport, Paoli, Pennslyvania, had recently purchased a Stearman-Hammond in San Francisco, California, and was flying it from the factory to Paoli. With him was Gene Moscow, an engineer for the Stearman-Hammond company. They were traveling in easy stages and had arrived in Roanoke, Virginia, that afternoon. The weather report from there to Paoli, their destination, was favorable, so they decided to try to reach Paoli by night.

At Wilmington, Delaware, they ran into a low ceiling and rain. When they reached Paoli they found ceiling and visibility zero zero, and couldn't see the lights set out for them on the field; so they started for Coatesville airport, hoping to find open weather there.

En route, they found a hole in the ceiling and went down to see if they could find a field to land on. Now an airplane flying in circles, a hundred feet above the ground and on a foggy night is sure to cause some excitement—which is did.

My brother and I rushed out of the house and onto a wheat field on our farm. Being a throttle pusher myself, it was plain to see that the pilot was lost, but that his motor was running properly. In the meantime, I found myself standing alone in the middle of the wheat field while my brother had gone back into the house to get a large five cell flashlight which shone up into the sky like a young searchlight. With this he attempted to signal them on to Coatesville airport, which is approximately five miles away.

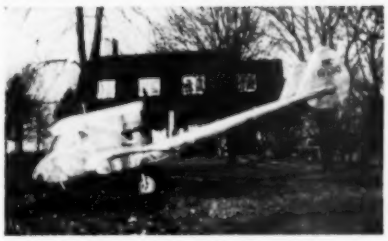
Moscow, who was flying the ship at the time, misunderstood the signal, blinked his navigation lights twice, cut the motor and started in for a landing. Now the wheat field is less than two hundred yards long and about one hundred yards wide with trees bordering three sides of it, and having never seen a Stearman-Hammond except for some pictures in POPULAR AVIATION (Stearman-Hammonds are as scarce here in the east as the U. S. Government has rigid type airships) I did not see how it could possibly get into the field without hitting the obstacles or over-shooting the field, knowing that any other ship would not be able to do it even in broad daylight. But all my thoughts didn't help any because "Mosky" was coming in.

He nosedived the ship for the center of the field, and pulled into a pancake just before hitting the ground in order to miss the trees. He intended to slam on the brakes as soon as the wheels touched. But this was unnecessary. When they came in they hit on all three wheels with such force that it buckled the nose wheel under the ship. Had it not been for the fact that the nose wheel was slightly turned to the left, this would not have happened. They skidded on the nose at about a 45 degree angle, the length of the ship in soft mud, then settled back on the rear wheels and stopped instantly.

The only damage done to the ship was the nose wheel buckling, the nose itself being pushed in a bit and the leading edge of the left wing tip being damaged slightly when the ship stood up on its nose. All this damage will amount to less than $150 in repairs.

Neither Al nor Gene were hurt. In fact, the jar was so slight that the boys' hats stayed intact on their heads. They stepped out of the ship and immediately asked where they were, then Al looked at the ship and didn't know whether to cry or cuss a blue streak, so he compromised and did both. But after giving the ship a close examination, he cheered up when he had seen the little damage that had been done. Both men agreed that had the field been hard, they would have made a perfect landing.

By this time there was quite a crowd of people gathering, so the ship was pushed to the edge of the field, near the house, where it could be watched.



Above are two views of the Stearman-Hammond. The wings have been removed.

While the ship sat in the field—and this is a fact—a well-known Downingtown automobile dealer approached Al and told him he would like to see it when it was repaired, ". . . that was the best demonstration I ever saw."

After mother had given the boys a meal fit for a king, they started for Paoli in a car, to get some tools.

After they had returned, they started to take the wings off. This did not take long because Gene, having helped to design the ship, knew where every nut and bolt was. As soon as the wings had been removed they were taken on a car, one at a time, to the Coatesville airport.

Early Sunday morning the ship was towed over the Lincoln Highway to the Coatesville airport where it was hangared until parts had been sent out from California. Then it was loaded on a truck and taken to the Luscombe airplane factory at West Trenton, New Jersey, where it was repaired and assembled, ready to fly.

From the standpoint of a conventional ship having had to make this forced landing, it would probably be a total washout. In fact, not so very long ago, a well-known make of ship, priced higher than the Stearman-Hammond, nosed over on its back when it hit a small mud puddle in making a landing at Roosevelt Field, Long Island, sending its pilot to the hospital. What would have happened had it landed in the conditions that the Stearman-Hammond did?

END

"HOW'S THE

by PHILIP Del VECCHIO

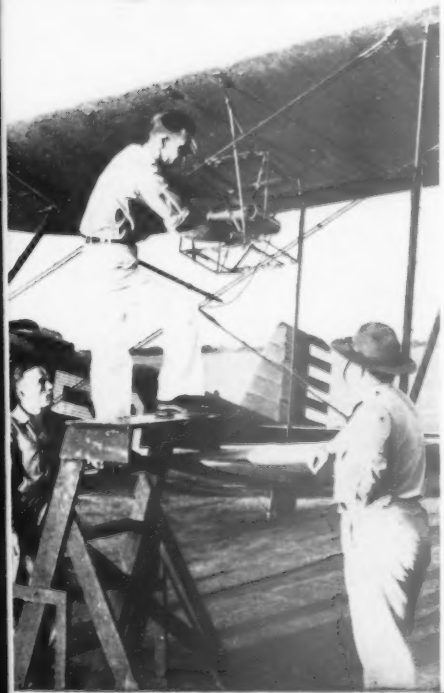
SECOND only to the perfect operation of the mechanical components of his airplane, the pilot's line of thought constantly comes back to a major feature of any flight—the weather. Air—the great mass of world-encompassing medium through which the airman must fly his ship—is seldom still. The winds veer back and change with altitude, the temperature rises and then falls to dangerous icy extremes, clouds and precipitation hinder visibility. All these elements, and many more, must be constantly watched so that a flight may be successfully completed.

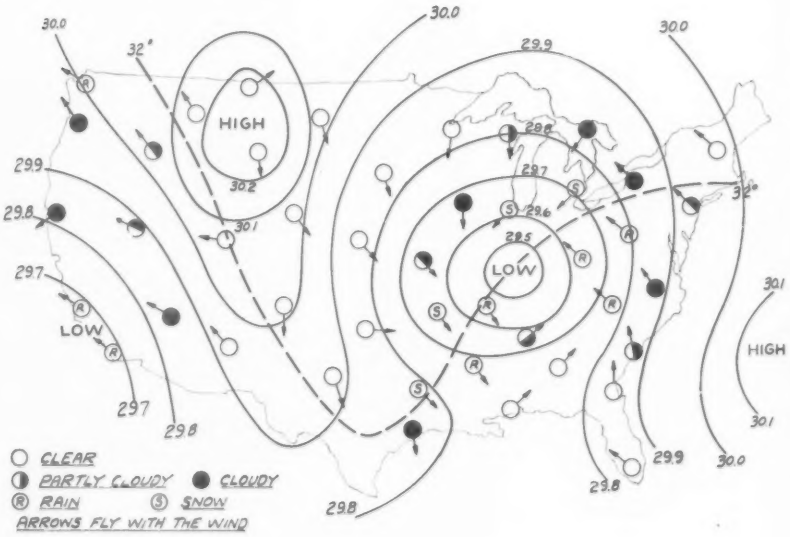
It becomes surprising, then, to find that so many aviation enthusiasts know their engines and their planes but little or nothing of the medium through which they fly. More surprising in the light of the fact that within the last few years developments have arisen in the meteorological field which have entirely changed the methods of forecasting weather and which have materially altered flying methods. Meteorology is a specialized subject and it is not expected that every man and woman in the aviation field should master the subject down to its fine details. There are, nevertheless, certain fundamentals which even schoolboys can understand and it is the purpose of these articles to bring out the salient and important features of present day aeronautical meteorology.

↓ The flying weatherman takes aloft an aerometeorograph on an Army ship.

↑ To the meteorologist, the above clouds are more than just a "pretty picture".

↓ Each day, all over the nation, meteorologists map the whims of the elements.





Weather?

This is for you folks who think the weatherman is a form of circus performer. Forecasters may err now and then, but the business of charting nature's many moods is a scientific masterpiece.

Benjamin Franklin is admittedly the father of weather forecasting in this country. It was in 1747 when, hoping to make observations of an eclipse of the moon, a northeaster set in at Philadelphia which upset his plans. When he found that his brother successfully made the observations in Boston he began investigations which convinced him that the direction of the wind was no criterion as to what direction the storm was moving. From a further study he found that the storm was an independently moving formation which carried its own system of winds with it. Gradually a system of collecting reports was put into operation and in 1891 the Weather Bureau came into its own as a branch of the Department of Agriculture.

Looking back on that quarter century of hard work and progress one may well be amazed to learn that within the last few years radical changes and theories have arisen which have invalidated even some of the most fundamental precepts of weather science. This is so not only in the United States but over the entire world. In other words, a science of comparatively sound standing has been forced to abolish a good many of the older and seemingly sound notions and go to work, not only on new theories but also with new tools. Some of the tools, in fact, had to be invented. In order to realize the significance and character of this change, it is necessary that a brief amount of space be occupied with a description of the methods used prior to these changes.

The "Pre-Frontal" Era

Every morning and evening at 7:30 the hundreds of regular weather stations throughout the United States take ob-

The radiometeorograph, an important "weather" instrument, is carefully tested before each flight. Signals must come in to ground observers clearly and with enough volume.

Pilot balloons (left) supply the meteorologist below with the direction and velocity of the winds aloft.

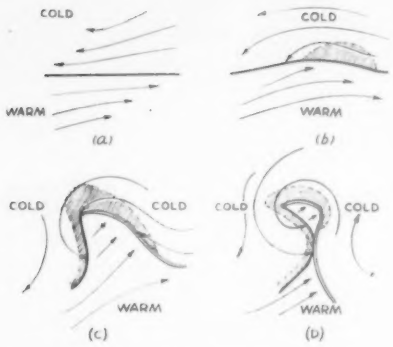
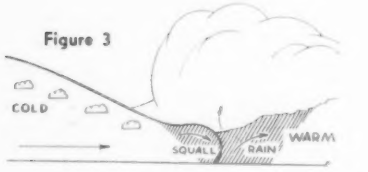
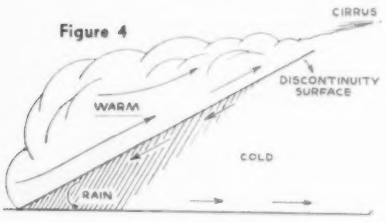


Figure 2 (above) illustrates the wave disturbance portion of the front theory of cyclones. Sections a, b, c and d show the steps this formation goes through. Figure 3 (below) is the vertical cross-section through the atmosphere of a representative cold front.





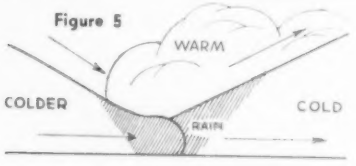
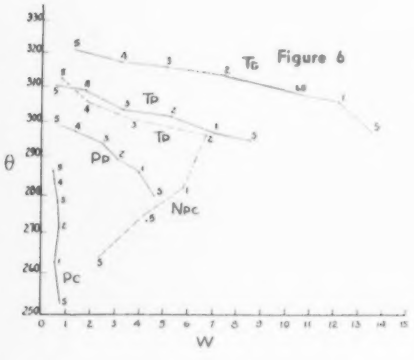
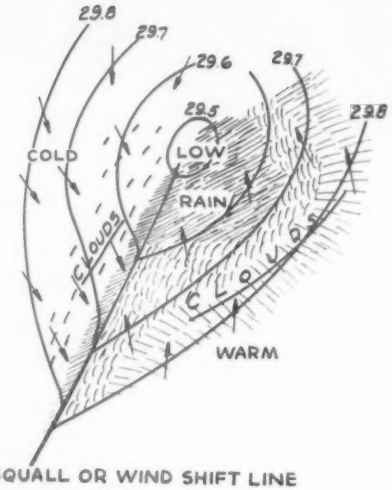


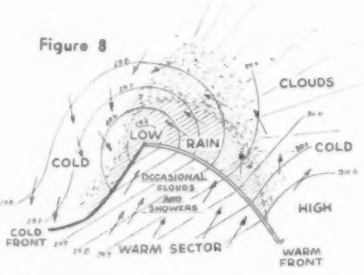
Figure 4 (above) illustrates a warm front and shows the upward-sloping discontinuity line. Figure 5 shows the occlusion of the warm air between two layers of cold. Figure 6 (below) is the famous Rossby diagram.





SQUALL OR WIND SHIFT LINE

Figure 7 (above) is the manner in which a cyclone usually is represented. This, however, is the old method of showing a storm on weather maps and is no longer commonly used.



The modern chart of a storm is shown above in Figure 8. Here the storm is segregated into three pronounced sectors. Compare the modern meteorological map below with Figure 1 on page 54. Figure 9 (below) eliminates much guesswork in weather-mapping.

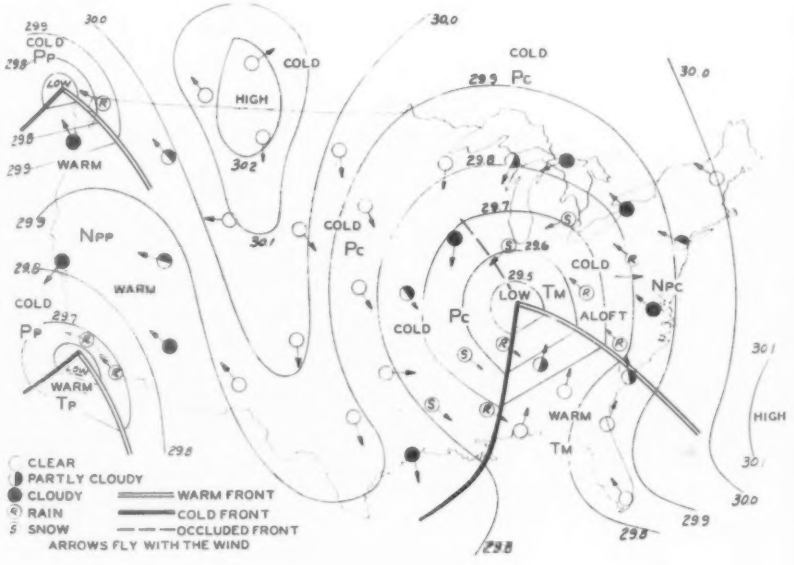
servations of barometric pressure, temperature, wind, weather and other phenomena. These observations are teletyped, telegraphed and sometimes radioed to Washington, D. C., and other key centers in the country, so that a few hours after they have been collected they are available to the general public in the form of forecasts.

At stations which make weather maps, the observations are decoded and entered on blank outline maps with appropriate symbols to denote the various weather states. Figure 1 represents a typical weather map of the United States. The solid lines are called isobars, and connect points where the pressure of the air is the same. For example, at any point along the isobar marked 29.9 the barometer will read just that—29.9 inches of pressure. It will be readily noticed that these isobars enclose areas of low and high pressure; which for all practical purposes we can consider as vast valleys and mountains of air, respectively. Toward the centers of the valleys (lows) the air pressure decreases—toward the crests of mountains (highs) the air pressure increases. These areas of low and high pressure have been found to move in a general west-to-east direction.

The striking feature of the map is the air circulation—shown by the wind arrows—inward and counterclockwise (*against* the hands of a clock), and outward, clockwise (*with* the hands of a clock)—inward toward the low centers and outward from the high centers.

The lows are usually accompanied by moderate or fresh winds, great cloud systems and usually by precipitation in one form or another. In the winter it may be snow, sleet or rain; in the summer rain or hail. The highs, on the other hand, bring light winds and fair weather. In the winter they are accompanied by cold waves. It is the procession of these areas which bring us the ceaseless changes in weather.

(*Continued on page 82*)



CAMERA MAPPING

by HELEN WATERHOUSE

Uncle Sam has found the aerial camera to be an ideal means of keeping tabs on the nation.

Tracing a field's boundaries with a planimeter gives its exact acreage.

THE gent who has the mythical job of tester in a mattress factory might, on first thought, be glad to exchange places with I. H. "Mack" Henry, or B. E. Kirkman, pilot and photographer, respectively, for the Park Aerial Survey Company.

Now employed by the U. S. Bureau of Agriculture to map out 20 counties in the Ohio district, these men work about 37 days a year—and in their stay in Akron, from the period of June 16, to September 11, they had an even softer snap of working only two six-hour days.

But on sober second thought, the soft snap isn't so soft after all. In fact this is one of the toughest flying propositions there is, so Henry says.

Just by way of proving that, let's first explain that aerial photography, such as these men are doing, is being promoted by the Agricultural Adjustment Administration in connection with the measurement of farms, fields, crops, and soil practices in the working out of a soil conservation program throughout the United States. It provides for benefit payments to farmers who divert acreage from depleting crops, such as corn, wheat, cotton, tobacco and soybeans, to soil-conserving or "building" crops such as alfalfa, clovers, etc.

B. E. Kirkman, high-flying photographer, adjusts the camera in survey ship.

Aerial photography first entered the picture when it was found that a decrease in the cost of measuring farms could be made in this way. The state of Ohio was picked as the first project ground for this photography. Basing at Akron, Ohio, the two heroes of our story were assigned to map 23 counties, with the stipulation that the pictures they made must be taken at 15,200 feet above sea-level, which is about 14,000 feet up over the Ohio terrain.

To get up that high, Kirkman and Henry used a commercial plane with a super-charged engine and an oversize propeller. As for the air, on the days they take pictures it must be as clear as the proverbial "day in June"—and that kind of a day is rare in Ohio.

In other words, there must be no clouds, no wind, no mist, no storm. That explains why there are only a very few days in the year when the mapping can be done.

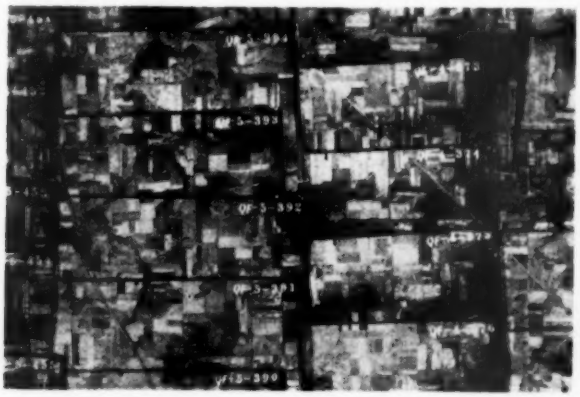
"We have been in Akron for three weeks," Henry said in an interview, "and we have not been able to do a stroke of work. We are getting to be expert loafers."

Due to the inclement weather in 1937, the government reported that only six counties in the project were completed and three others partially so. As early this spring as possible, flying operations will again be resumed here. The height at which Henry and Kirkman fly necessitates taking the oxygen aloft.

"We would become very groggy if we didn't," Henry explains. "Two tanks of oxygen containing 820 pounds of gas furnish enough oxygen to last us through an eight-hour working day," he said.

"We hold a little rubber inhalator to our noses and immediately feel much 'pepped up,'" he added, "but correspondingly, the next day we feel much

This is Licking County, Ohio—straight down. Large prints of negatives like this clearly show all survey necessities.



Photographic index maps like this one of Portage County, Ohio, can be made so as to accurately show entire states.

let down and very jittery. It seems to be the effect of the oxygen."

He admitted it also might be due to the fact that this is the hardest flying he ever had to do in his life.

"I always thought I could fly in a straight line but when it's necessary to keep approximately within 1,000 feet of a certain line, it's a different story," he said. "We are only allowed one degree of tilt on a picture and that's a pretty small amount. We fly so high, we are able to take six square miles of territory per picture."

Before they go up, the Messrs. Henry and Kirkman go over the best ground maps they can get, lay out the areas by lines and then, when flying, never vary more than 800 feet from those lines.

Kirkman holds a stop-watch while Henry holds the ship on line. The stop-watch is necessary because the pictures must be taken at regular intervals to insure the proper overlapping.

The ship itself is a flying photograph laboratory. The camera is mounted in the floor with the lens thrust through a hole in the floor. The windows are covered with black curtains, so that the 75 foot rolls can be changed while the plane is in the air. The pictures are taken at a scale of 1,667 square feet, and in strips spaced approximately two miles apart.

After the pictures are delivered to the Department of Agriculture, they are inspected and, if acceptable, are then sent to the field where the exact scale of each picture is determined. Enlargements are then made to a scale of 660 feet to the inch. These enlargements are sent out in the field and the various field boundaries are located on these pictures.

Pilot Henry has done this work for three years. He is army trained and worked for the Department of Commerce before taking over one of the world's most leisurely jobs. His skill was tested to the utmost in the job which just preceded his flying in Akron, when he mapped for the Bureau of Agriculture in the Great Smoky Mountains of Tennessee. The only maps available of this trackless region were some which had been made by the government shortly after the Civil War.

Henry found many a road and river which was completely at odds with those old time maps. Previous to that assignment, Kirkman and Henry mapped a section of the Mississippi Delta from Vicksburg to Baton Rouge—which had never been mapped before.

"We found lakes back there that probably have never been fished. There's no way to get to them except by plane because of the surrounding swamps. Believe me, I'm going back sometime for some fishing," he chuckled.

There are 10 or 12 companies in the country doing aerial survey work and all of them have more work for public and private agencies than they can handle, Henry says. So if you want a job, working less than one day a week, with a pay check every week, there are plenty of them open.

END

Aeronca—Now and Then

The 1938 Aeronca combines good appearance with many fine flying qualities and comfortable conveniences and appointments.

SOME twenty centuries ago, the Mussolini of the Roman Empire, a Generalissimo named Julius Caesar, began one of his stories on "The Glories of War", like this: "All Gaul is divided into three parts" . . . and the same might be said of flying.

All aviation is divided into three parts, the military, the commercial, and private flying. The greatest branch of the three is private flying, for that's where some 50,000 people, who get a big kick out of flying, find the opportunity to do most of it.

The average person becomes interested in flying through all of these channels, but the simplest means of entering aviation is through private flying. Ten years ago it was not easy nor inexpensive to learn to fly an airplane. Today this has been changed, largely because of the commercial light airplane.

As long ago as 1927, the Aeronautical Corporation of America recognized the urgent demand for low cost flying. The Aeronca C-2, introduced in 1929, was the answer. This popular light airplane offered the student who wished to build up flying time, an opportunity to do so at small cost. The picture shown of the Aeronca C-2 was made on the recent Aeronca Air Cruise to Miami, Florida.

The reliability of these early planes is shown by the thousands of hours they have flown. Though the planes were originally designed for single seaters, they were often used to carry two passengers. This ship was unbelievably light with an empty weight of 398 pounds and a gross weight of 672 pounds. Contrast this with the average private plane of today which grosses anywhere from 1,000 pounds up to 24,000 pounds and it is evident that they were really light planes.

In the picture is shown an Aeronca C-2, built in 1930, which has been in constant service ever since. The present owners are R. J. and E. E. Sudderth, newspaper men of Chattanooga, Tenn. This early Aeronca is capable of performance which compares very well with present day planes of its class.

High speed	85 m.p.h.
Landing speed	31 m.p.h.
Ceiling	20,000 ft.

Considering everything, this is really

And here we hark back to the ancestor of the modern Aeronca.

commendable performance for a plane equipped with an engine of 26 h.p. as the C-2 Aeroncas were.

In 1931, the Aeronca *Collegian* two-seater was introduced. One of the first to buy this type of plane was Fred Hight, a pilot well known out in the Black Hills of South Dakota.

Probably no plane was ever put to more unusual uses than Hight's Aeronca. Many a coyote learned the futility of trying to escape from his Aeronca. On one occasion, a gang of bank robbers were apprehended with this plane. Hight logged over 3,000 hours before he traded his C-3 in on a new Aeronca. In this time repair bills had totalled approximately $50.00.

The new 1938 Aeronca brings to the lightplane new features and appointments that could not be found in the most expensive ship of a few years ago.

The lightplane buyer now has a choice of engines when buying his plane—either the Aeronca, or Continental. Dual wheel controls have taken the place of the older control stick. Oleo landing gear has replaced the rigid gear. Comfortable heated cabins instead of the open cockpit of ten years ago. Position lights, tail wheel, radio, and many other accessories can now be found on the ship.

Thousands of people are yearly swelling the ranks of amateur and private pilots because flying costs have been reduced and flying made safer.

Facts and figures show that flying is becoming increasingly popular. Every lightplane manufacturer is running far ahead of the production schedules of one or two years ago. At the Aeronca factory in 1937 production was increased 103 percent over the 1936 production schedule. The estimated production for 1938 will pass the '37 schedule by a wide margin.

AERIAL SEDAN

For the "well-fixed" private pilot, this Waco is an ideal transport, either for business or pleasure.

GIVE THE OLD BOYS

Here is where many of Racine's "tired business men" spend their spare hours. When this picture was made, an N.A.A. air tour was visiting Racine's airport.

This is for you young bloods who think flying is some special gift reserved for your youthful wings. Read on, then mind your manners.

AVIATION is a young man's game. It demands eagle vision, iron nerves,—the instant co-ordination of mind and muscle, characteristic only of youth.

And aviators are supermen—reckless, glamorous, daredevils endowed with uncanny abilities denied to ordinary mortals.

That's what the public used to think. That's what the newspapers used to say. But at Racine, Wis., home of one of the largest and most active airports in the midwest, they call those theories a "lot of applesauce." A young man's game? Hooey!

Middle-aged men at Racine have proved that flying demands intelligence, —sound common sense—clean minds and bodies; that and nothing more.

Supermen? Reckless, glamorous dare devils? That always gets a horse-laugh out of 60-year old, spectacled, scholarly Jim Craig, manufacturer of candy machinery. And Jim ought to know for he has been piling up hundreds of solo hours in these last five years.

Aviators are born, they're not made! Amusement wrinkles the lips and eyes of iron-gray Jim King, wealthy Milwaukee automobile distributor. If not in his usual tolerant and genial mood, Jim might snort his bitter contempt of such a philosophy. "Brains — that's what counts in flying," Jim will bark. And he, too, ought to know whereof he speaks, for he has been flying for four years. In that time he has piled up 1,000 solo hours and has purchased three airplanes. After making his solo trip around the field, Jim bought a biplane. In this he flew to the east coast several times. Sensing the need of sedan comforts and conveniences, he bought a Stinson. This he recently traded-in on a later model, equipped with radio and blind flight instruments. Mr. King is governor of the Milwaukee chapter of the NAA and commander of a Milwaukee Legion post which dedicates most of its activities to the promotion of aeronautics.

Eagle vision? Removing his "specs" while he meditatively polishes the lenses, John Crawford, middle-aged engineer of the J. I. Case Co., will solemnly assure you:

"No, flying merely demands normal eye-sight."

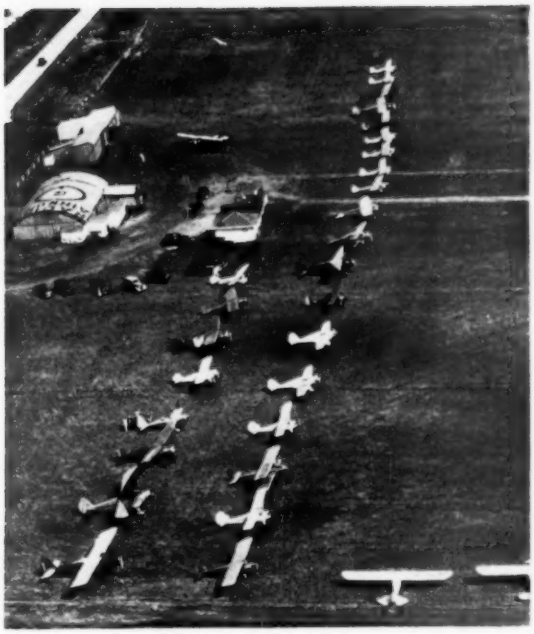
And Mr. Crawford, one of the engineers who helped to design and test the famous old Curtiss OX-5 which powered the wartime Jennie and many of her illustrious descendants, also speaks with some authority for he flies his own plane regularly on business trips between Racine and the J. I. Case plants at Rockford and Moline, Ill. Although Mr. Crawford wears glasses he can see well enough to pick out a good clover field when bad weather forces him to "set down." Mr. Crawford's son Ted, also a Racine flyer, is more apt to hotly dispute the "aviation-is-a-young-man's-game" theory for he's very proud of his father's aeronautical accomplishments.

Racine's flying old-timers include (left to right) Frank Rohan, Carlyle Godske, John Crawford and Oscar Jacobson. The author's wife (front) is an ace airwoman.

Gillie Jackson is over 40 and is considered to be one of Racine's aces.

A CHANCE

by FRANK LOVELL



It's not an uncommon sight to see Racine's flying old-timers lined up like this on a bright afternoon.

Ever hear of Frank Rohan? He's part of the brains behind the Nash automobile—automotive engineer, big game hunter, dead shot, a camera fiend and a middle-aged aviator. If folks aren't looking, Frank will sneak his glasses out of his breast pocket when he reads, but he can land his Waco taper-wing on a dime. Youthful co-ordination of mind and muscle? Frank Rohan, who loves to take a nap with the cat on his lap, will never see 40 again but he can roll and spin and loop his crate all over the sky.

And Oscar Jacobson! Looks like a middle-aged Rotarian. Or the president of the First National. Flits all over Europe on the airlines. President of the Jacobs Manufacturing company, he's here today and there tomorrow. But for trips across the United States, he uses his own Great Lakes biplane. He thinks this "youth-must-be-served" business is a lot of poppycock.

Consider the case of the "Prof," another Case company engineer, and B. D. Eisendrath, millionaire president of the tannery that bears his name. And Carlyle Godske, president and founder, chief instructor and directing genius of the airport, is 42.

Carlyle has owned more than a dozen planes and his license authorizes him to pilot almost anything, except, perhaps, the *China Clipper*. Carlyle has crossed and criss-crossed the continent dozens of times. He was forced down in the Everglades but cheated the alligators. And two or three times he had to get down by the uncertain light of flares dropped during blizzards. But he still manages to put in four or five hours a day despite his advanced years; he says his rheumatics don't bother him much, even in a cross-wind landing.

"Fig" Landreman, Carlyle's chief lieutenant and assistant instructor, is no spring chicken even though he is one of the airport youngsters. Fig, who admits that he'd hate to have "been hanging since I was 35," has 1,500 hours in his log-book and is the only flyer at the field ever in a serious crackup. Flying in an air-circus race, Fig hooked wings with a competitor while rounding a pylon. Fig went down in a flat spin. His ship was a total loss but Fig was able to walk away from it. In a desperate endeavor to pay for the plane, Landreman tried to break the world's record for the greatest number of consecutive parachute jumps. He sprained his ankle, but insisted on continuing the attempt. On the tenth jump, the chute dragged him backward across the field. Concussion of the brain kept him in the hospitial for months.

A young man's game? Well, the kids do all right but in Racine their dads seem to do a better job. The old boys seem to have a funny idea that experience counts the most. And maybe—despite eloquent and learned contentions

Middle-aged, wealthy Jim King learned to fly in 1934, has owned three ships.

Carlyle Godske, Racine airport manager (left), was snapped during the Wisconsin State Air Tour with Racer S. J. Wittman (center) and Col. Howard Morey.

of swivel chair aviators and flight surgeons—maybe they're right.

But that's only part of the Racine story. Deep beneath the surface there is a bigger, more important and more significant yarn,—a tale of a dream that came true.

The Racine airport has become one of the most important and most active fields in the central states. Department of commerce figures prove that. So do records of fuel dealers. More aviation gasoline is consumed in Racine than anywhere else in Wisconsin, except at terminals of the big airliners. And Chicago parts, repair and accessory dealers have other figures to confirm Racine's claims.

In January of this year, Manager Godske let contracts for the first phase of an $8,000 building and expansion program. Three new hangars are being built. Five others will be erected before summer. The place already has three hangars—one large and two small ones—a machine-ship, office and a clubhouse. The mechanic is on the job day and night for he sleeps at the airport.

But it took time—almost ten years—for this dream to come true. The field has never experienced a boom or mushroom growth. In 1928, it was just another cow-pasture with a hangar in the northwest corner. And the hangar housed a Fleet biplane. Students reported for instruction on Saturdays, Sundays and late in weekday afternoons. Stunting was prohibited; safety rules were enforced and the Kinner-powered Fleet was kept in tip-top shape. Bit by bit public confidence was established, but for many and many a month Carlyle Godske paid his bills out of his own pocket.

Nobody knows just how it happened, or just when it happened. But all of a sudden business began to sit up and take notice of the flying field. One by one, without any beating of drums or newspaper ballyhoo, business or industrial executives, engineers, an artist or two and even an occasional millionaire

(*Concluded on page* 86)

Two ships in the Racine fleet.

Our Front Cover: Britain's Shadow Shading

Leonard Bridgman

THE man you see above is one of the leading international authorities on aviation. He not only knows world aeronautics inside and out; Leonard Bridgman also is one of the outstanding aviation artists. His paintings on the front and back covers of this issue of POPULAR AVIATION are proof of that.

Leonard Bridgman has been a noted aviation authority for many years. Born in London 41 years ago, he still makes that city his home. In answer to our query, Bridgman added to his biography:

"My education followed normal lines, the general intention being that I should assimilate enough learning to qualify for a job in the Civil Service. Anything tending to deviate me from a path to middle-age security, such as certain artistic inclinations—then mainly devoted to defacing my school books with life-like representations of my guides and mentors—were studiously suppressed, or at any rate, discouraged. Nevertheless, I had my first aeronautical drawing published in 1913 in an advertisement for the Grahame-White School of Flying. I also had my first passenger flight in a Maurice Farman biplane at this time.

"At the outbreak of the War I was still at school. In 1915 I joined the Honourable Artillery Company and after 2½ years in the infantry I transferred to the Royal Air Force and ended the War in an anti-submarine unit on the East Coast (of Great Britain).

"From the R.A.F. I joined the staff of 'The Aeroplane' (a British aviation weekly—Ed.) as an artist and two years later began my association with 'All the World's Aircraft' (a voluminous annual aviation directory of the world; considered to be somewhat the Bible of aviation—Ed.). I spent 15 years with 'The Aeroplane', during which time my artistic activities gradually took second place to editorial work. My drawing work was mainly devoted to sketching the innards of aircraft to illustrate technical descriptions of new aeroplanes.

"In 1934 I resigned from the assistant editorship of 'The Aeroplane' to gain a long-wished-for freedom to do my own things in my own way. That brings us to today, when I am still doing my own things in my own way and liking my independence. . . . I am neither married nor have I ever fallen foul of the law. I once set foot in the States in 1928 but I only spent four days in New York, so that I have no excuse either to praise or criticise your police, your central-heating or your liquor."

Leonard Bridgman, then, is admirably well qualified to present that work of his appearing in this issue. Hence, his paintings of not only the British aircraft he chose, but of the "shadow shading" as well, is the most authentic material of its kind obtainable.

"Shadow shading" was adopted by the Royal Air Force in 1937 to replace the plain silver or aluminum dope finish which had been standard since shortly after the War. In the "peaceful past" such a highly reflective finish was tolerated for economy purposes. However, in the "more disturbed present", as Bridgman puts it, silver-doped fabrics, polished metal cowls, unpainted metal skins or flashing metal propellers are far from being desirable. Instead, "shadow shading" was devised by British air officials. Now, a ship so painted has its sides and upper surfaces covered with irregularly-shaped patches of dark green and dark brown. The undersides of bombers are finished in black; of fighters, in silver. With the exception of manifolds or pipes and tires, every part of the aircraft has been treated by "shadow shading". Propellers are painted a dull black all over. In addition, Royal Air Force ships with this camouflage scheme have their familiar red, white and blue identification rings set off by a circle of yellow.

There are two schemes of "shadow shading". Scheme A (for single-engined and twin-engined bombers) is shown on the Fairey *Battle* on the front and back covers. Scheme B is a "mirror image" of Scheme A; it is the same design reversed as if seen in a mirror.

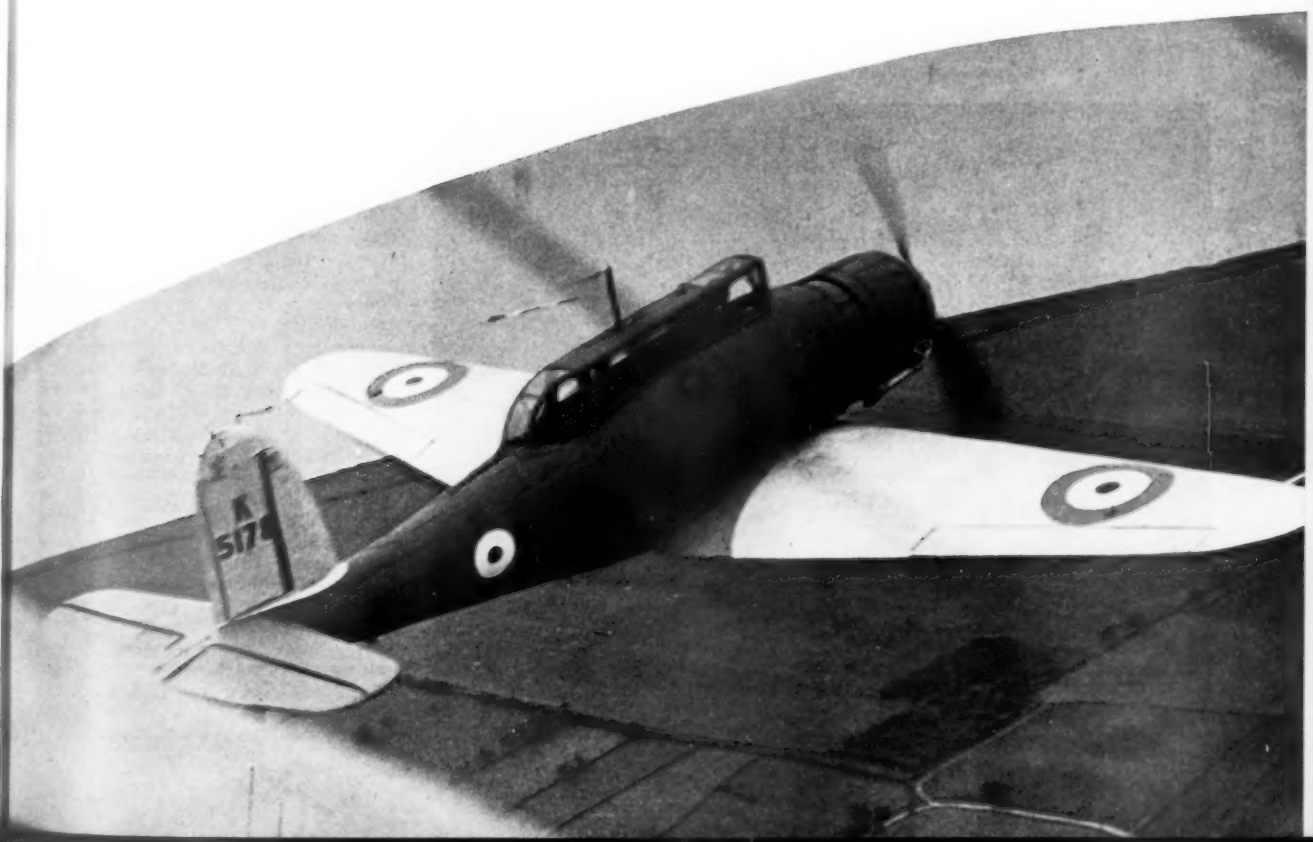
Bridgman has used the Fairey *Battle*, Bristol *Blenheim* and Handley Page *Harrow* as the representative single-engined medium bomber, twin-engined medium bomber and twin-engined heavy bomber respectively for POPULAR AVIATION's covers. All three of these models are in standard production for the R.A.F.

The *Battle* is one of the world's fastest single-engined light bombers with a reported speed (at 15,000 ft.) of 257 m.p.h. Cruising at 200 m.p.h. at 16,000 ft., the *Battle* has a range of 1,000 miles. The *Blenheim* is a three-place all-metal monoplane with a top speed (at 15,000 ft.) of 279 m.p.h. At cruising speed (200), the *Blenheim* also has a 1,000-mile range. The *Harrow* is a four-place heavy bomber and, at a cruising speed of 163 m.p.h., has a range of 1,250 miles.

END

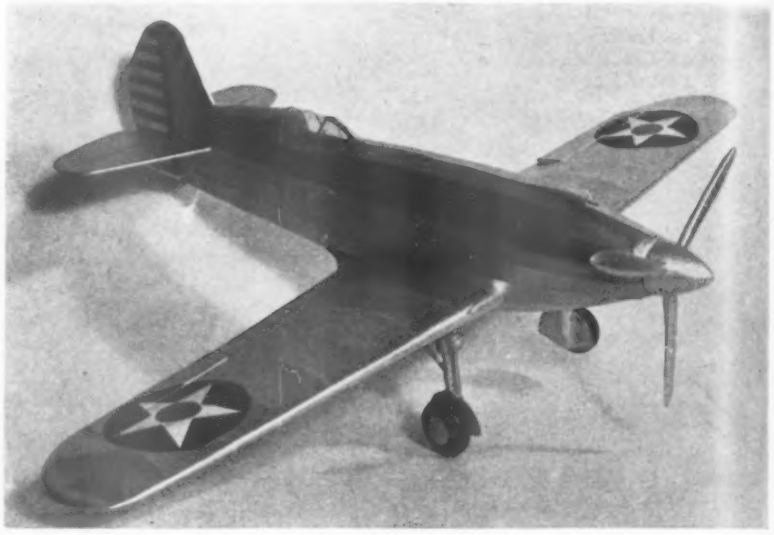
HARRIER

GREAT BRITAIN'S first monoplane dive bomber produced for Naval use aboard aircraft carriers is named after the rapacious jaeger or the gull-like skua. The Blackburn company chose a particularly fitting name for their new warplane, for the mission of their *Skua* is to perform the functions for which the skua is known: the harassing of weaker birds until the latter surrender or disgorge their prey. The Blackburn *Skua*, being Britain's latest warplane, is a strict military secret. The engine is the new Bristol *Perseus* with sleeve valves.



Building the Curtiss P-37

by
PAUL W. LINDBERG
Model Editor and Model designer for POPULAR AVIATION



Completely finished and ready for flight, this little Curtiss P-37 is a real duplicate of the full size ship.

NOW to give you "rubber-powered" fans a break, we feature this trim little fighter now being tested for the Army Air Corps. It is the last word in streamline designs and its performance will thrill you beyond words.

Construction of Fuselage

Main longerons of the body are constructed from $\frac{1}{16}$ square balsa. These are placed on the plan with a sheet of wax paper between it to keep framework from adhering to plan when the cement has been applied. After the two sides have been built remove and place in an upright position on top view of plan. The cross members are now cemented into position to form a rectangular shape.

From $\frac{1}{32}$ inch sheet balsa, cut the formers to outline shape and cement in their respective positions. The nose block is now shaped and cemented to front of rectangular fuselage, so that the stringers may be applied. The position of the stringers is clearly shown. Although we advise you to check from front to rear in applying these so that you might secure the proper alignment. Stiff paper is used to form the cockpit.

Construction of Wings

Construct these upon a flat surface in very much the same manner as the fuselage sides. Carefully cut all ribs to the proper shape from $\frac{1}{16}$ inch balsa sheets. Notch these carefully and cement over main spar. The leading and trailing edges are next cut and sanded to shape. Cement these carefully to the ribs. The wing panels may be built with or without the ailerons. We recommend movable ailerons with aluminum hinges as they form an excellent means for controlling the model.

Construction of Elevator and Rudder

These are constructed from $\frac{1}{16}$ inch square and $\frac{1}{16}$ inch sheet balsa for the rounded tips. The elevator is constructed in two separate units and attached to either side of the fuselage with individual struts on the under side of each for supports.

Construction of Landing Gear

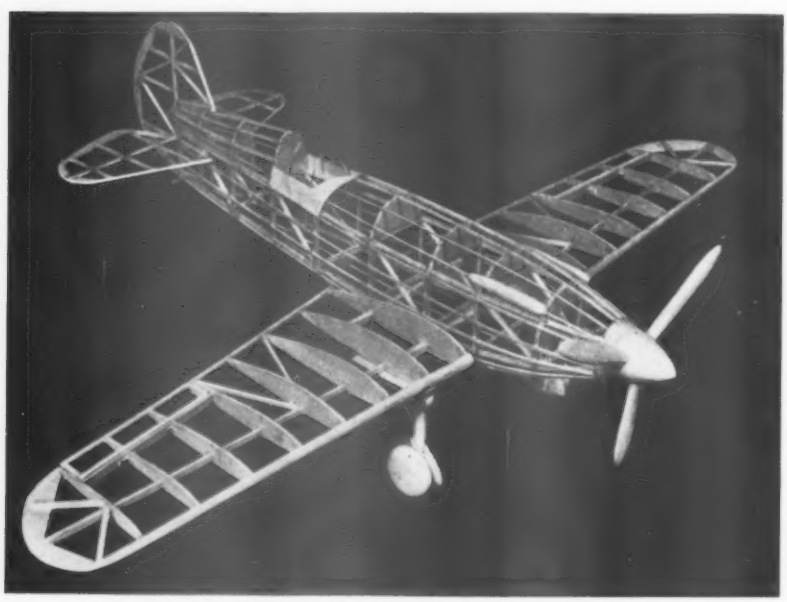
The landing gear struts with their intermediate parts are built up from a strong grade of balsa. A little patience is required here in order to secure the proper shape. Do not cement these struts in position until wing panels have been covered.

Covering the Model

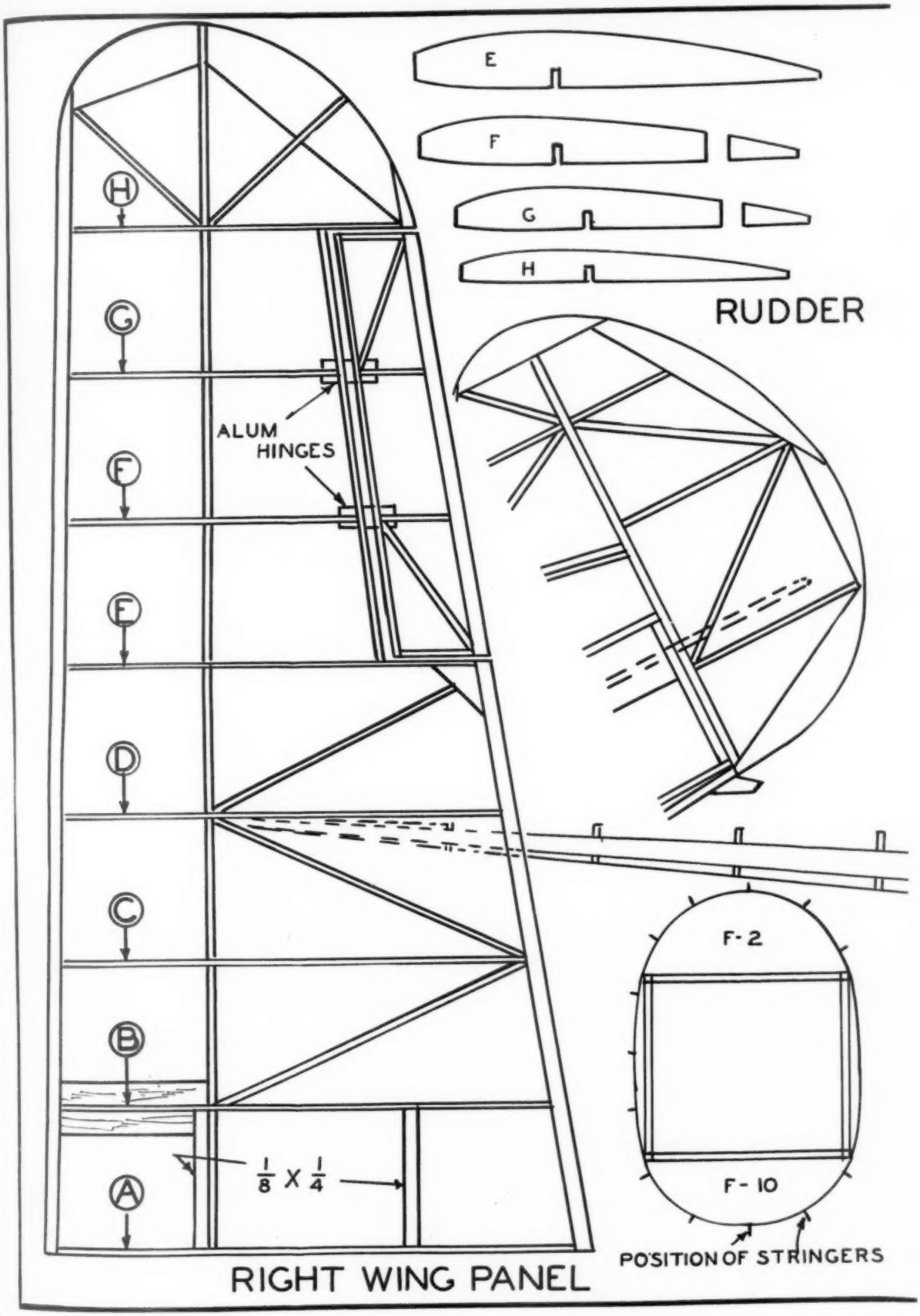
Do not attempt to cover the body with too large a piece of tissue as this will only cause a poorly covered model. For best results, cover in long strips from stringer to stringer. This method requires a little more time but your efforts will be well repaid in the end. The wings are more easily covered. Cover the top sides first and repeat this procedure for the bottom side. After all parts have been covered, apply a light coat of water over the entire surface which will cause the tissue to shrink. A small insect sprayer is an ideal method of applying the water. Pin elevator and wings upon a flat surface so as to prevent any warping. The clear dopes are now applied two to three coats are sufficient.

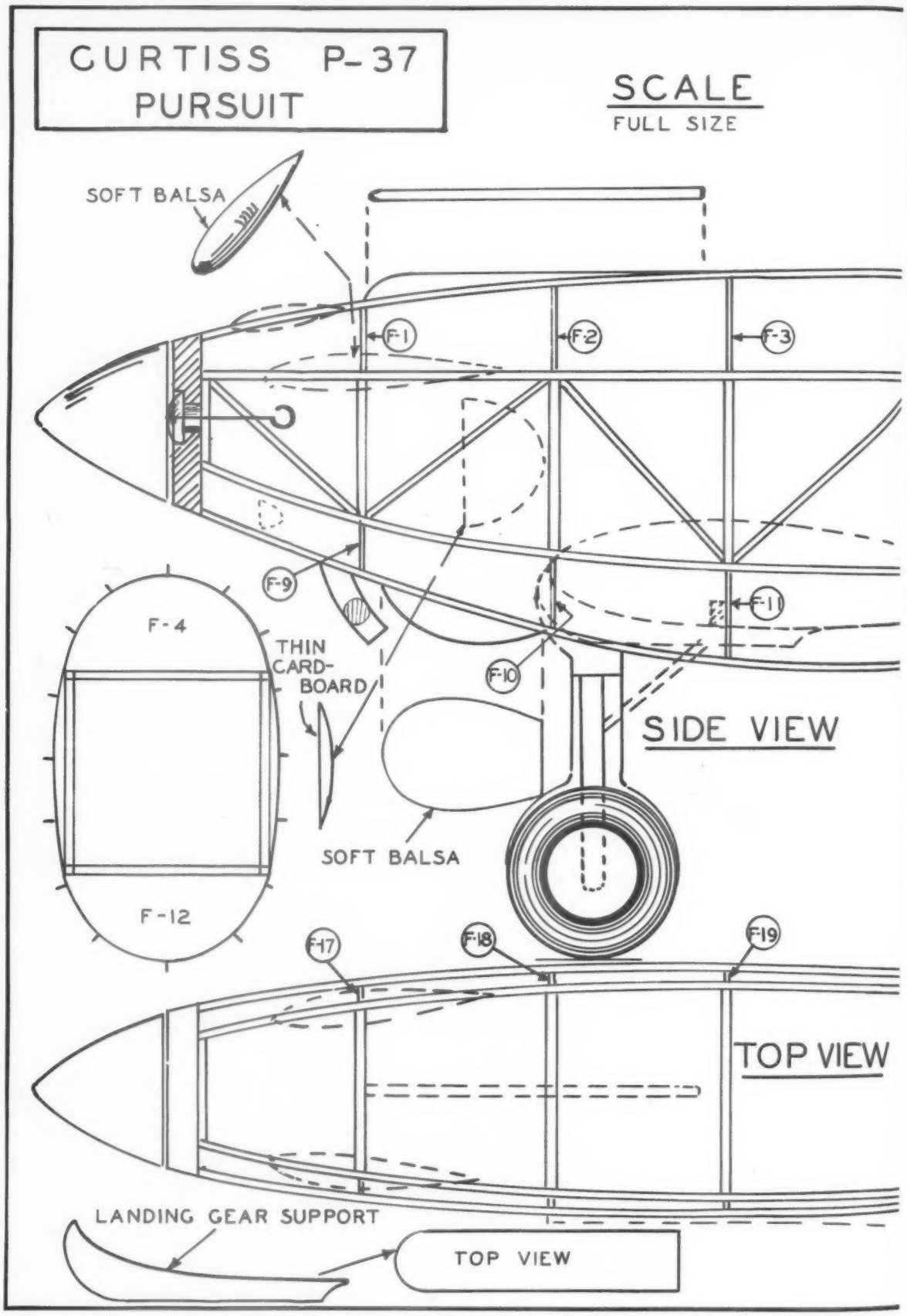
Finish coating is not simply for appearance, for a full doping and a taut tight skin also is essential to high speed and efficiency.

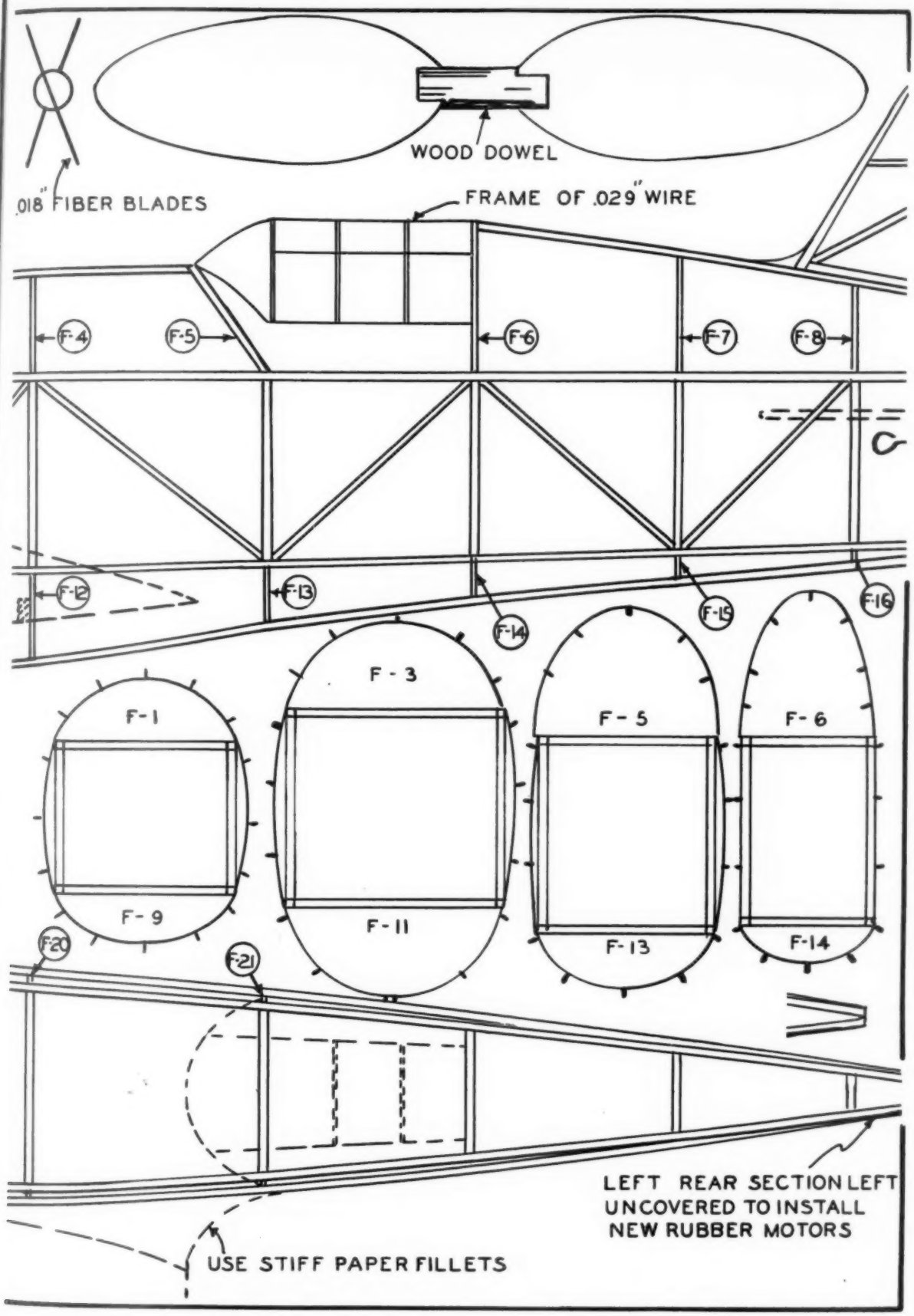
END

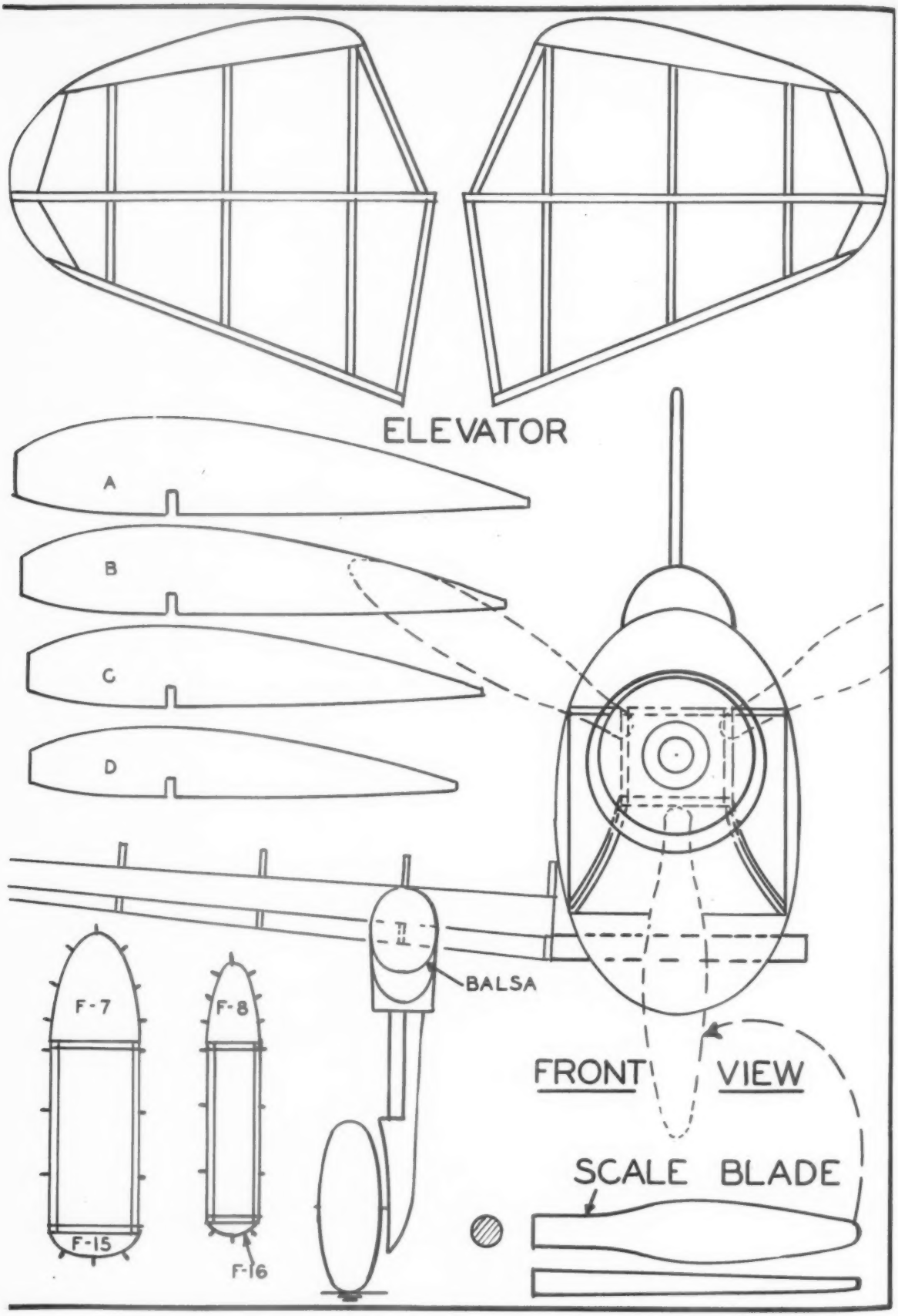


Using this assembly photo in combination with the drawings, simplifies the construction.


E
F
G
H
RUDDER
H
G
F
E
D
C
B
A
ALUM
HINGES
1/8 X 1/4
RIGHT WING PANEL
F-2
F-10
POSITION OF STRINGERS


CURTISS P-37
PURSUIT
SCALE
FULL SIZE
SOFT BALSA
F-1
F-2
F-3
F-9
F-11
F-4
THIN
CARD-
BOARD
F-10
SIDE VIEW
SOFT BALSA
F-12
F-17
F-18
F-19
TOP VIEW
LANDING GEAR SUPPORT
TOP VIEW


WOOD DOWEL
.018" FIBER BLADES
FRAME OF .029" WIRE
F-4
F-5
F-6
F-7
F-8
F-12
F-13
F-14
F-15
F-16
F-1
F-3
F-5
F-6
F-9
F-11
F-13
F-14
F-20
F-21
LEFT REAR SECTION LEFT UNCOVERED TO INSTALL NEW RUBBER MOTORS
USE STIFF PAPER FILLETS


ELEVATOR
A
B
C
D
F-7
F-8
F-15
F-16
BALSA
FRONT VIEW
SCALE BLADE

Alone Across America—Blind!

(*Continued from page 30*)

and dirigible pilot. With Captain A. W. Stevens he teamed up to attempt the first Army-National Geographic stratosphere project. He rode that great, bursted bag down to within 500 feet of the earth before he took to his trusty parachute to save his neck.

In the meantime, he had learned to fly airplanes. I flew pursuit formation with him during the year at the Air Corps Tactical School and found that he could stick in an acrobatic formation or a "dog fight" with the best of them. Furthermore (and what really decided me), he had a true love for the air game; adventure was his next door neighbor and best friend.

The safety pilot had another function to perform. He was to keep my cockpit cover under constant observation, so that he could certify at the end of the journey that I had made the flight without outside vision.

So it was that we climbed into two Boeing P-12s 30 minutes after we graduated from the Tactical School and headed for New York for the beginning of the transcontinental blind flight. On the way we practiced our system and perfected our signals and routine.

On one point we had spent no little time in thought and discussion. We agreed that we needed some positive signal for me to uncover promptly in case the radio failed and some emergency arose demanding immediate attention. Between Wilmington and Philadelphia on the way north I was flying under the hood when Bill's voice came over the radio: "I am going to fly close above you and jazz my engine to see if you can hear it above the roar of yours." There was a spell of silence, then: "Did you hear that?" I had to admit that I had heard nothing save the thunder of my own nine cylinders. In a few minutes he came in again, "Where am I now?"

"You are in front of me close and your propeller wash is about to blow me out of the sky," I said, sketchily, as I fought to regain control of my crazily maneuvering plane. A pilot never mistakes a good dose of propeller wash. He seemed pleased as pie. His voice came in filled with satisfaction, "That will be our signal," he said, "if I can't raise you on the radio and I want you to uncover at once, I shall dive down immediately in front of you, give you a strong whiff of my propeller wash. When you fall out of control you will know that it is time to uncover." I admitted that I would.

At noon June 3, we took off from Mitchel Field and headed for Washington on the first leg of our blind flight. At five minute intervals Bill's voice came in over the radio to tell me that all was well. As we had agreed, if he did not call me at five minute intervals I was to give him a call; if unable to raise him on the radio, I was to rock my wings, which was our positive signal for him to call me. If he did not then call, I was to uncover. It would mean that our communication system, essential to safe blind flight, had broken down completely. At the end of an hour and 50 minutes of flying without incident, Bill called me and said, "You are now over Bowie racetrack. Alter your course five degrees to the right and you will come in over Bolling Field."

On the next leg, from Washington to Spartansburg, S. C., we had our first unprogrammed event. We had just passed Richmond when my radio brought me an order, "Change your course 30 degrees to the right." I knew we were on the beam and could not be that much off our course. That was more of a change than would be necessary to avoid an oncoming plane. It must mean bad weather ahead. Shortly another insistent message said: "Change your course 40 degrees to the left." It was not long until it got so dark inside that I had to turn on the light to see the instruments. Then mist began to sift into my little cubicle. We were in a squall. I knew that, too, by the way the plane was bouncing around. Thereafter, for the next few minutes, messages came in thick and fast for me to change direction and to go lower. Finally, Kepner said, "Fly as straight as you can, I am coming in to fly right on your wing." For a time the only messages which came said, "O.K." Bill told me later that we had reached a point where he could see nothing due to the heavy storm, so he had pulled into tight formation and sat there, both of us flying blind. He could not watch his instruments and see my plane at the same time, so he just kept the top wing of his plane lined up with mine. At one time he said, "Perhaps you had better uncover, Ira; we are down to a thousand feet and it looks very dark ahead, I have been guiding you around thunder storms, but now I can't see any openings. We shall have to turn back or plow through." I told him that I preferred to plow through. "O.K.," he said. "I have just heard the Department of Commerce weather broadcast, and it is all right about fifty miles further along." It was very rough and we bounced around a lot. It was very hard to hold a course. Eventually we came through into clear skies again. We had not been afraid of colliding with other planes on the airways, because we were flying at the westward altitude. By Department of Commerce ruling, planes flying blind going West cruise at odd numbered thousands of feet, one, three, five, etc., while planes flying East cruise at even numbered thousands of feet.

BLIND-FLYING, now an essential training for transport pilots, has developed amazingly during the past three years. Its importance was first recognized in the United States where night flying on the airlines was a much more common practice than in Europe.

This story demonstrates the accuracy with which instrumental flying (another name for blind flying) can be conducted and indicates the high efficiency of the methods now in use, although they are primitive when compared to developments yet to come.

Automatic pilots, radio controlled airway tracks, automatic landing devices and similar equipment will eventually make scheduled airway operation the safest of any known system of transportation.

Our next untoward incident occurred on the leg between Ft. Worth and Midland, Texas. Shortly after passing Ft. Worth, I began to get directions to go lower and then lower. Finally, he told me to pull up to 3,000 feet slowly and fly as straight as possible. I knew what that meant. He was blind again, and was going to fly formation on me until we came out on the other side. In about half an hour he said: "O.K., now, we are in the bright sunshine. I didn't tell you before because I didn't want to put anything else on your mind, but you pulled us through about 50 miles of clouds again. I was as blind as you were."

Over west of Deming, New Mexico, I had another uncomfortable spell. Bill had been telling me at half-hour intervals where we were so that I could plot it on my map. At one time he said: "You are now five miles south of Rodeo," I marked the position on my map and saw that directly in our path lay a peak considerably above our present altitude. If we continued on our present course we could not avoid it; in fact, it was very near at hand. To me, it meant either that Bill did not know our position or we must have more altitude to clear the peak. I did not want to disclose any lack of confidence in my director by asking questions, but I did sneak in another five hundred feet of altitude. In talking it over later, he said that I had misunderstood his statement of our position. He had said that we were five miles north of Rodeo, not south of it.

As we came up out of Imperial Valley and neared San Gorgonio Pass, I told Bill that I wanted to go through the pass at about 6,000 feet. I knew that it was so narrow that in less than five minutes I could hit either side. He said, "I am sorry, but we can't go through at that altitude on account of the low clouds, but I shall call you every minute so that you will know that everything is all right." As we approached the pass it became very rough. My little plane was tossed from side to side like a terrier shakes a rat. But the reassuring voice came over the radio, "You are 500 feet above the ground now; we are just entering the pass; hold your present course and we shall split it in the middle." Then again, "You are over Banning now," and later, "We just passed Beaumont." I knew that already, for the air had calmed down, it was cooler, and I could even smell the orange scent in the air. I knew where we were as well as he; we had broken through to the coastal plain; in less than an hour we

The Story of De Havilland

(*Continued from page 42*)

into the DH-81A, which incorporated enclosed cockpits, the design was scrapped. This ship was known as the *Swallow Moth*.

A modified version of the famous *Gypsy Moth* next appeared, the DH-82 *Tiger Moth*. In many respects this job closely follows *Moth* design, but has swept back wings, a higher horsepower engine and generally "beefed-up" construction. The *Tiger Moth* is still being produced in numbers and has proven to be very popular either on floats, wheels or skis. The radio controlled *Queen Bee* is a ship of this type, modified for target purposes by the British Air Ministry.

A miniature transport next appeared, the DH-83 *Fox Moth*. This trim little job carries three passengers in a cabin between the wings, and provides for the pilot in an open cockpit to the rear. A *Gypsy* Series III engine of 120 h.p. is used, and floats, skis or wheels may be fitted.

A twin-engined airliner next appeared, the DH-84 *Dragon*. This economical transport, with its two *Gypsy Major* engines, first appeared in 1932 to meet the need for a small ship for unsubsidized airlines and charter operators. Nearly a hundred of these *Dragons* were built before the design was discontinued in favor of the newer and faster *Dragon-Rapide*.

The DH-85 *Leopard Moth* was a development of the *Puss Moth* and, although no longer in production, many are in use throughout the world. It is slightly larger than the *Puss* and carries three people with a 130 h.p. *Gypsy Major* engine.

One of the best known modern DH's is the DH-86 "Express Air Liner". This ship uses four of the 200 h.p. *Gypsy Six* engines and has proved to be an excellent transport for longer runs. It is of all wooden construction and ships built to date number close to 100. A modified version is now in production, the DH-86B, and features triple vertical fins for added stability and split wing flaps for slower landings. Imperial Airways and Qantas Empire Airways (in Australia) use these economical airliners on many of their routes.

Although the *Gypsy Moth* is no longer being produced, a popular two place side-by-side cabin biplane, the *Hornet Moth* is proving to be a worthy successor. The DH-87 *Hornet Moth* has many of the features that made the older *Moth* famous, among them folding wings, easy control, economical operation and the latest form of the *Gypsy* engine, in this instance the *Gypsy Major* series I. Top speed is 124 m.p.h. and range with 45 gallons of gas is over 600 miles. It has a rate of climb of 690 f.p.m. and reaches a service ceiling of 14,300 feet.

De Havilland next ventured into a new field, that of long distance racing, when developing the famed *Comet* DH-88 for the London-Melbourne air race. This all-wood monoplane uses two special *Gypsy Six* racing engines and attains a top speed of well over 230 m.p.h. Three ships of the *Comet* class were built. The success of these ships seems to indicate that wooden construction is not so far out of the aircraft picture as many have been led to believe.

The next production job is the DH-89 or *Dragon Rapide*, which is likewise of wooden construction. Using two *Gypsy Six* engines of 200 h.p. this trim tapered wing biplane carries a load of eight passengers, one pilot and express at slightly over 155 miles per hour. Ships of this type are being made in the Canadian De Havilland company for skiis or pontoons at present.

The DH-90 *Dragonfly* is a smaller version of the *Dragon Rapide* and uses two 130 h.p. *Gypsy Major* engines. Five passengers are carried and a top speed of 145 m.p.h. is attained. Construction is of wood; the fuselage being an oval monocoque section and the wings being of wood with fabric covering. Like the DH-89, this job can also be used on skiis or floats.

The two latest products of the DH company are the DH-91 *Albatross* and the DH-93 *Don*. Both ships feature usual wooden construction and the newly developed *Gypsy King* V-12 engines. The *Albatross* mounts four of these 500-600 h.p. units in extremely clean cowlings, while the *Don*, a Royal Air Force advanced trainer, uses one of the air cooled, geared *Gypsy Kings*. The *Albatross* is intended for fast transoceanic and intercontinental flights with mail, passengers and express and test flights to this country will likely be started early in 1938. It will be interesting to see how this modern wooden ship stands up in comparison with our latest all metal craft.

In addition to this vast "family" of airplanes the de Havilland Company also builds its own engines, ranging from the 90 h.p. *Gypsy* to the new 500-600 h.p. *Gypsy King*. It has also acquired rights to manufacture the Hamilton-Standard controllable and constant-speed propellors in Britain and is at present supplying these screws to many manufacturers.

There are today somewhat over 6,000 de Havilland aircraft in use, and nearly as many de Havilland *Gypsy* engines. The de Havilland company maintains five associated companies in the Dominions as well, and maintains a world-wide service organization. What is the more remarkable is that Captain Geoffrey de Havilland, who in 1908 designed, built and flew his first airplane, has had an active hand at all times in every airplane turned out by his factory from the DH-1 to the DH-93.

END

MIDGET RACING
Get full details on this thrilling sport; facts for fans, builders and drivers; track sizes and regulations; car specifications, pictures and working drawings. This book also shows and tells about Indianapolis cars, Miller-Fords and world's fast cars. AUTOMOBILE RACING, Fourth Edition, $1.00 postpaid, $1.15 C.O.D.
RAY F. KUNS,
Dept. E-17, Madisonville, Cincinnati, Ohio

BALDA, ½ 120, Meyer Trioplan F:3.5 lens in Compur shutter. Good condition $25.00
FOTHFLEX, Twin lens reflex, 6x6 cm., F:3.5 lens, Focal Plane shutter. Like new $43.50
SOLIDA, coupled range finder, full and half 120, F:4.5 Tessar lens in Compur shutter. Like new..... $39.50
SUPER IKOMAT C, Zeiss Tessar F:4.5 lens in Compur shutter, coupled range finder. Like new..... $49.50
BEIRA 35mm. Coupled range finder, F:2.9 Cassar lens in Compur shutter. Good condition $59.00
GOLDI, ½ vest pocket, F:4.5 lens. Like new $14.50
DOLLY, ½ vest pocket, F:2 Xenon lens in Compur shutter. Good condition. $43.50
PILOT 6 Reflex, F:4.5 lens. Like new $18.50
GRAFLEX Model B, Revolving back, 3¼x4¼ Kodak Anastigmat F:4.5 lens. Good condition $45.00
RECOMAR, 9x12 cm. F:4.5 lens in Compur shutter. Coupled Kalart range finder. Excellent condition..... $61.50

All items unconditionally guaranteed
Sold subject to 10 day trial.

Send for Free Complete Photo Bargain Booklet
FOTOSHOP inc
136W 32nd St. New York, N.Y. Dept. PA-5

KOLLSMAN
PRECISION AIRCRAFT INSTRUMENTS
KOLLSMAN INSTRUMENT COMPANY
INCORPORATED
8008 FORTY-FIFTH AVE., ELMHURST, N.Y.
WESTERN BRANCH: GRAND CENTRAL AIR TERMINAL, GLENDALE, CAL.

THE NEW 1938 CUB SEAPLANE

NOW..FOR ONLY
$425 DOWN
You Can Get a
CUB
and Learn to
FLY
A REGULAR COURSE OF FLYING INSTRUCTION
FREE!

Combine the thrill of speed-boating with the sport of flying by getting a new 1938 Cub Seaplane—the lowest priced seaplane in the world! Although priced hundreds of dollars lower than any other seaplane, it comes complete with both genuine Edo Floats specially designed for it and regular wheel landing gear, which are quickly interchangeable.

The new Cub Seaplane will land and take off from small or large river, canal or lake as well as ocean. It is completely metallized to protect fuselage and parts from salt water. By using a light wheel undercarriage, it may be easily beached. Its dependable, 4-cylinder motor provides power, performance, safety and economy that cannot be equalled. Owners report gasoline consumption of less than three gallons per hour and little or no oil!

Here is the easiest-to-fly, easiest-to-buy seaplane on the market. Be sure of early delivery by ordering your new 1938 Cub Seaplane NOW!

FREE FLYING COURSE

Every purchaser of a new Cub airplane is entitled to a free flying course including dual flight instruction by a Government licensed instructor. Get a new Cub for only $425 down and learn to fly your own plane without paying a cent for dual instruction. See the new Cub at your dealer's and ask for a free flight demonstration.

FREE!

Send today for full details on the free flying course, free Cub folder and name of your Cub dealer. Paste coupon—or write your request—on penny post card, if you wish. Piper Aircraft Corporation, 58 Aviation St., Lock Haven, Pa.

LOW PRICES

CUB TRAINER	$1270 F. A. F. Factory . .	$425 DOWN
CUB SPORT	$1395 F. A. F. Factory . .	$465 DOWN
CUB SEAPLANE	$1895 F. A. F. Factory . .	$635 DOWN

PIPER AIRCRAFT CORPORATION
58 Aviation St., Lock Haven, Pa., U.S.A.

Please send me full details on the free flying course, free Cub folder and name of my Cub dealer. No obligation.

NAME_____

ADDRESS_____

CITY_____ STATE_____

COUNT THE CUBS

THE WORLD'S FASTEST SELLING AIRPLANE

Billy Mitchell Warned Us!

(*Continued from page* 12)

badly under-powered. It could scarcely get altitude enough to fly over a church steeple. But it was the evidence of an idea. It represented an ardent desire for a large long range bomber. In those days aeronautical engineering skill had not caught up with Mitchell's dreams.

Some of his best brain children were doomed to still birth or to fatal malady in infancy.

Today every great air power of the world is placing its reliance for air supremacy on the giant long range bomber. It has been demonstrated in the current wars that the essence of air power is range.

In one of the warring nations today there were two airplane factories. One of them was within the range of the bombers of the attacking foe. It is gone; no longer does it turn out planes to aid in the protection of its land and people. The other factory was situated beyond the range of the attacking bombers. Today it is working triple shifts, returning observers tell us.

There you have the story in graphic and gripping detail. The influence of warring nations will extend no further into the land of the antagonist than their airplanes can fly, deliver bombs and return home again.

The Barling bomber, that giant mouse trap, that animated bird cage, that stick and wire monstrosity—Mitchell's Folly—should be placed with loving hands in a museum; it should reside henceforth in our historical archives; it should mark the birth of an idea. Worthless then and worthless now as a war weapon, it was nevertheless the earliest archaic model of the most powerful military weapon in the world today.

When the Flying General tried to mount a one-pounder cannon in an army plane in 1922, it didn't work; it was abandoned as a visionary project. Again, the state of the industry had not arrived at a point where a plane could be built which would properly support guns of that calibre.

Today, cannon are appearing on the latest fighters of all the air powers. In the United States just last year appeared the Bell multi-seater fighter, carrying two such cannon, and boasting great and high ceiling. It was the exemplification of another Mitchell idea grown to manhood.

In the early twenties, as the fiery flying general went up and down the land like a ragged prophet of old crying in the wilderness, butting his head obstinately against the stone wall of ignorance and reaction, we told him what would happen to him; we counselled him that he was years ahead of his time. He would not listen. He replied that succeeding years would be his justification. It appears that he was right at least in part. The late '30s have demonstrated by practical planes that his dreams of the early '20s were not fevered hallucinations.

It is a tragedy, the saddest of many tragedies which dogged his colorful career, that he did not live to see the fulfillment of his prophecy.

AUTHOR'S NOTE. The opinions and prophecies contained in this article are entirely my own and are not reflections of the opinions of the U. S. Army or Navy officials. JAMES E. FECHET.

END

Airy Chat

(*Continued from page* 9)

temptation to remark that the South Atlantic was flown before the Lindbergh era by men just as brave but not so assertive.

* * *

OUR old and good friend, Joe James, former Gates Circus pilot, kindly sent us a note in which he remarks that he is now in the employ of the United Fruit Company, flying a dusting plane in Central America with which he is dusting banana trees. Unfortunately, we have mislaid this letter and if this paragraph meets Joe's eye, we wish that he will get in touch with us immediately.

* * *

BEG YOUR PARDON. On page 50, of the April issue, there is a numerical error so great that it should be self-evident. To head off a flock of correspondence on the subject, we will say that the numeral 7,000 should be 700, and the numeral 10,000 is properly 1,000. Such errors will happen in the best regulated families.

* * *

THERE is a lot of popular agitation in the newspapers on the subject of Diesel engines for airplanes and the public is being told only half (or less) of the whole story.

The learned daily press quotes page after page on the safety and efficiency of the Diesel engine and, as the final proof, states that the Diesel is in extensive use on the German airlines. When a daily newspaper wishes to put emphasis upon any scientific or engineering feat in support of an argument, Germany is always chosen as the final authority.

But all is not gold that glitters, as the airlines of this country have discovered after trying out the so-called Diesel principle. They found, first of all, that no Diesel engine is as reliable as a gasoline engine and the reliability factor is paramount. Second, the use of fuel oil is no guarantee against a fire, and this was demonstrated on several occasions.

* * *

AMAZING STORIES, a unique magazine with a field and style all its own, has very recently become a member of the Ziff-Davis Publishing Company.

In short, it deals with scientific facts related in entertaining form so that the dryest dust of science becomes an entertaining story. We strongly recommend this magazine to our readers who, we are sure, will appreciate the ingenuity of the compilation.

* * *

WE wish, humbly, to point out an omission in the April issue of POPULAR AVIATION. We unfortunately failed to credit TWA with the photographs used in the article "Mock-Up". Once more we beg your pardon.

* * *

AND, again, we reach the end of the column for this month. Meet you next month in the same place. J. B. R.

"Will Enemy Bombers Darken Our Skies?"

Harrison Forman FAMOUS PHOTOGRAPHER AUTHOR AND EXPLORER

GIVES YOU HIS VIVID, AUTHORITATIVE CONVICTIONS

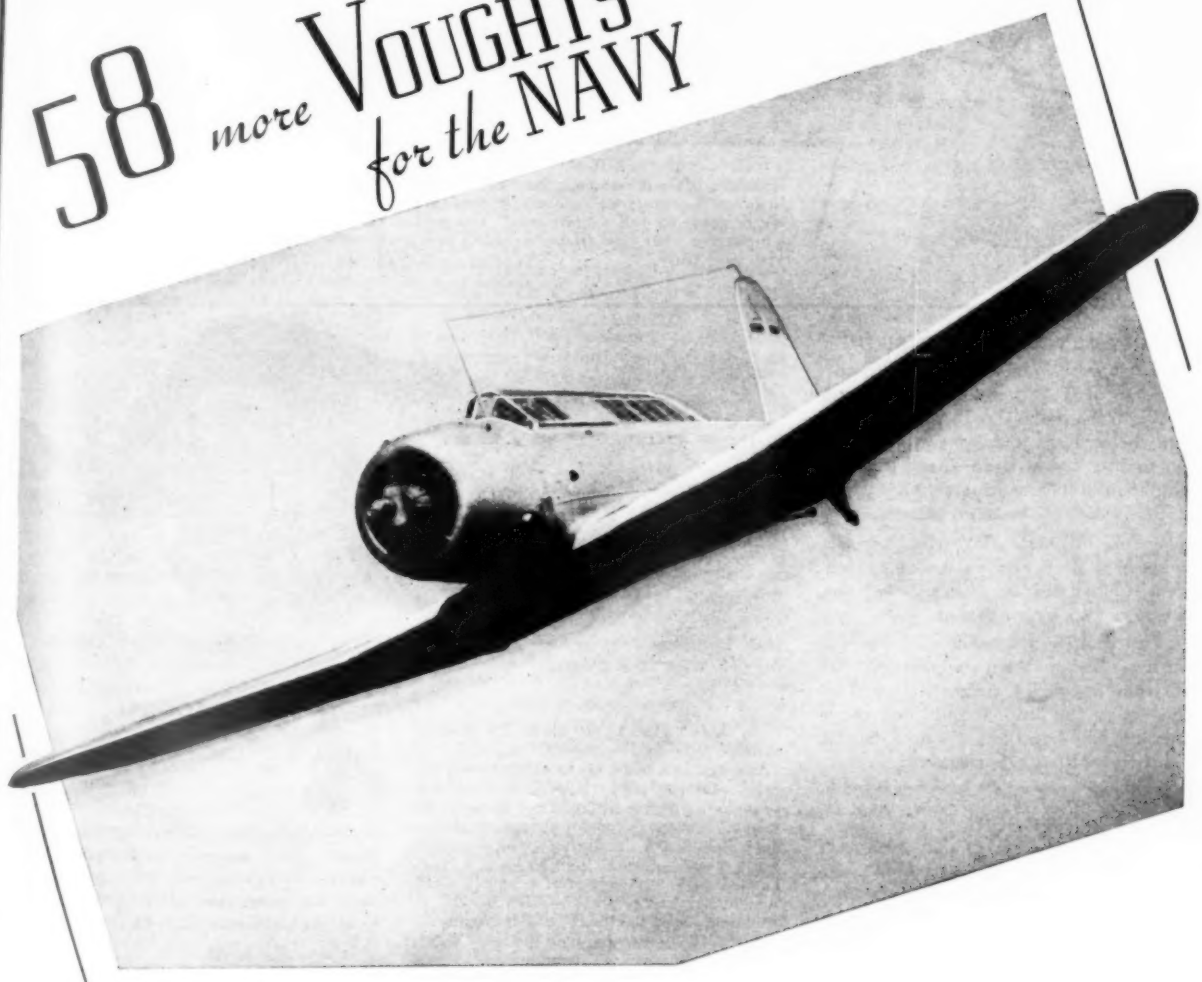
While the jittery nations of Europe are in a headlong armament race in preparation for the "next World War" . . . should we bewail our defenselessness? Should we visualize enemy bombers spreading horrible death and destruction over our land? Should we worry . . . wonder . . . be alarmed? Just what is the extent of our national security?

For the answers to these vitally important questions—plus dozens of other new, exciting feature articles

DON'T FAIL TO SECURE YOUR COPY

JUNE ***Popular Aviation*** ON SALE MAY 10th

58 more VOUGHTS for the NAVY



The performance of the Vought SB2U-1 has been so satisfactory that a repeat order for 58 additional airplanes, officially designated as the SB2U-2, was recently awarded by the United States Navy . . . Again Chance Vought demonstrates the thoroughness of its twenty-one year experience in producing outstanding aircraft for service with the fleet.

CHANCE VOUGHT AIRCRAFT

EAST HARTFORD • CONNECTICUT

ONE OF THE FOUR DIVISIONS OF UNITED AIRCRAFT CORPORATION

The Birdmen's Perch

Frankly, it's puzzled us quite a bit the way everybody and his uncle has taken to the little brain-teasers we've been slipping into the Perch recently. One of these fine days we're going to pull a "fast one," and publish the Grand-Daddy of all Puzzledom. So simple that your best friend wouldn't tell you—yet it's never been solved! Till then, yrs. very truly, MAJOR AL WILLIAMS, alias "Tattered Wing-Tips," Mgr., Gulf Aviation Dept., Gulf Aviation Products, Gulf Bldg., Pittsburgh, Pa.

ANYWAY, IT KILLS THE BIRD

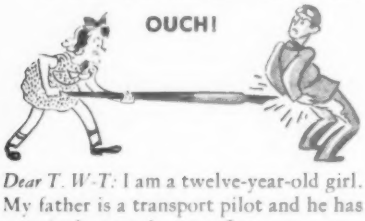
Dear Major Williams: In answer to the question of what happens when a bird flies into the propeller of a plane. It will kill the bird . . . cause the propeller to go to bits and will no doubt tear the engine from its mounting.

—Vincent Lynch, Niles, Ohio

Dear Sir: In questioning what happens when prop meets bird. I saw such an incident at Floyd Bennett when a Daily News Plane met up with a pigeon.

The result was that the bird was cut in two, as though with a butcher-knife. The bird lost very little blood . . . and on inspecting the prop, I could not find a speck of blood, feathers or sign of impact. There were three eye-witnesses.

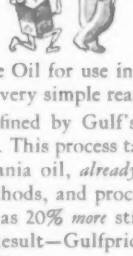
—N. R. Giancarlo, Sixth Battalion, U. S. N. R.



Dear T. W-T: I am a twelve-year-old girl. My father is a transport pilot and he has promised to teach me to fly.

In the December issue I read about the flyer who passed the balloon and then went back for another look. It asked for wind velocity. Please send me the answer. Besides I wonder what business he had flying without instruments.

—Frances Sherman

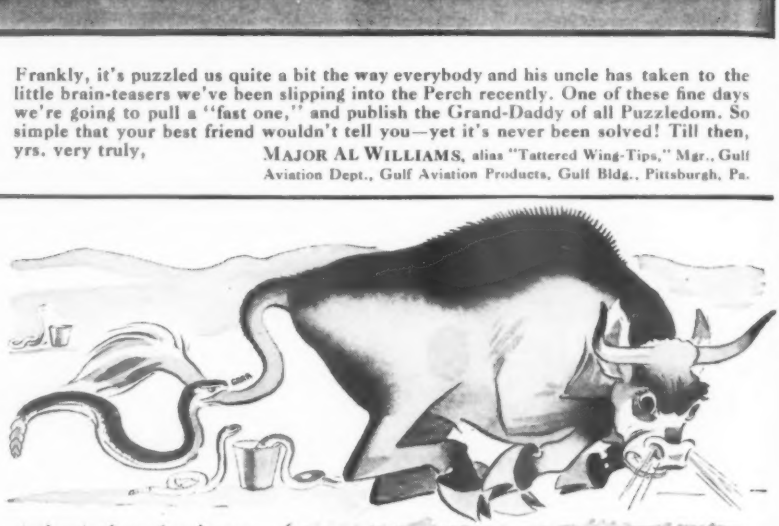


We propose Gulfpride Oil for use in the finest planes, for this very simple reason:

Gulfpride Oil is refined by Gulf's famous Alchlor Process. This process takes 100 percent Pennsylvania oil, *already* refined by ordinary methods, and proceeds to yank out as much as 20% *more* sticky sludge and waste. Result—Gulfpride—"The World's Finest!"

AS OTHERS SEE OUR PUZZLERS

"Professor, that wasn't cricket"—A. G. Becker, Pres., Pittsburg Inst. of Aeronautics . . . "H.O.T.F.M.A. (Home of the Feeble-Minded Aviators)" — 'Speed' Ericson, Jr. . . . "As crazy as a bed-bug, as nutty as a fruit-cake"—Sam Stites . . . "No soap"—Harry Watson . . . "I agree with you" — Walter Hoffman . . . "I don't think you'd pull one like that"—John Bell, South Carolina . . . "I knew there was a catch"—Jesse F. Bell, W. Va. . . . "Vaccinated with a phoney-graft needle"—Cecil Knight . . . "You're Nerts" — Hen Shepler . . . "Who turned off the wind?" — Clif Durling . . . "Friends are scratching bald heads"—Ralph Walker . . . "Screwy"—GeorgeSouth . . . "Don't weaken"—Jerry Hoffer . . . "You got me figuring"—John Potts . . . "So fooey on your 100 m.p.h. stuff which only confuses a guy"—Rev. C.E. Frazier . . . "Plenty vague"—R. Westmoreland . . . "Racking my brain for two seconds"—C. Meshberger . . . "Why should a man in his right mind . . . ?" —Andy Rose . . . "It was three pilots who left Bradford, Pa. for Philadelphia, and landed in N. Y."—Rosemary Brewster, Helen McBride, Lee Jenkins . . . "Why don't somebody tell me these things"—E. McDivitt . . . "They pep you up just like that Good Gulf Gas."Charles Kurleman. (*That's right, Charlie!*)



Authentic photo of rattler scoring "bulls-eye" (see Whopper)

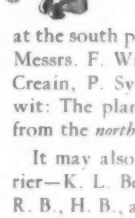
THIS MONTH'S WHOPPER

Dear Al: Any fledgling who doesn't get the Bughouse Navigation Problems should be recommended for loss of his navigator's license at once.

P. S.—You know, we had to quit using Gulf Aviation Gasoline set out in bowls to kill grass-hoppers out here, because all the rattlesnakes started to score bull-eyes, striking from twenty to thirty feet.

You see, after drinking it, they thought they were rockets, and would just straighten out toward an enemy and let the good old Gulf Aviation Gas power surge just *blast* them on their way!

—Capt. J. C. Adams, Fort Lincoln, N. D.



APOLOGIES!

We said that the "only" way a plane could get back to its starting point (Feb. Problem) was by starting at the south pole. Our face is reddened by Messrs. F. Windsor, J. Rodenhausen, R. Creain, P. Sykora and W. Roycraft, to wit: The plane may start 115.915 miles from the *north* pole, too. Thanks!

It may also start from an aircraft carrier—K. L. Beck, W. Doymon, R. Ross, R. B., H. B., and L. J. "It's the curvature of the earth"—E. Nelson. "The earth rotated west to east"—A. Niewenhoff. Also from on top of a coupé . . . Oh, well . . .

Try this! Three planes start off at the same time, two of them in pursuit of the third, and both 100 miles behind it. One of the pursuing planes has exactly the same speed as its quarry, so never closes in. The other, however, catches up with it—Bingo!—shoots it down, and returns to join its mate. They meet at exactly over the spot their quarry started. How far did the unfortunate plane travel before being brought down?—(Idea thanx to Blake Henderson)—Drop T.W-T. a line for the answer!

Gulf Oil Corporation and Gulf Refining Company . . . makers of

GULF AVIATION PRODUCTS

Across America—Blind!

(*Continued from page 69*)

should be over the Pacific and at journey's end.

Looking back over the episode, one thing stands out for me. All of us have heard it said that the other senses of the blind become more acute to make up for the loss of sight. I never realized how true that is nor how quickly those other senses build up to take the place of sightless eyes. Many times had I crossed the continent on that route; I thought I knew every foot of it well, but I saw things on this blind flight over that trail which I had overlooked before. The first sense which began to assert itself was smell. As we approached the Mississippi I knew it long before Bill told me. I could smell the mud and damp of the bottomlands. Then, just after leaving El Paso, Bill said, "You are now over the west end of the city, just going around Mt. Franklin." I knew that, too. I could smell the copper smelter, which always throws up a green column of smoke into the hot dry atmosphere. As we came up through Gorgonio Pass I knew when the Pacific breezes began to seep into the cockpit, there was the unmistakable odor and the change in temperature.

My hearing, also, became more alert. I could tell by the minute inflections in Kepner's voice when he was concerned, or worried. I could tell when he began to get tired from the arduous grind of long formation flying.

It has been no little satisfaction to me to complete the first transcontinental blind flight. It has been said in some uninformed quarters that Army pilots do not fly blind. Many people do not know that it is a part of our basic training; that we have to do some of it every month. As a matter of fact, the Army Air Corps has played a leading role in instrument flying. An Army pilot, Major James Doolittle, made the first blind landing. Major Albert F. Hegenberger made the first blind landing without a safety pilot, flying as the only person in the plane. The Air Corps' Material Division, at Wright Field, the best experimental unit on things airwise in the world, has been the agent for developing a large majority of those invaluable instruments which make blind flight possible. More than 200 Army planes were equipped with turn-and-bank indicators, the basic blind flying instrument, before they appeared on other planes.

It seems to me, too, that there must be some reassurance for airline passengers when their pilots pull up into the clouds and the earth blanks out below, to know that it can be done with safety hour after hour; in fact, it has been done entirely across the continent.

For me, the fatigue and nausea and headaches and moments of suspense on the journey across America blind are compensated for by the memories of an interesting experiment—another one for the Army's Flying Corps.

END

Suicide Crew

(*Continued from page 24*)

latter craft they are among the most skillful in the world.

Directors have learned that the two Franks, Clarke and Tomick, are an unbeatable combination when stunting scenes are found in the script. Clarke does the stunting and Tomick pilots the camera ship following his twisting aerobatics.

And many a cameraman, after one of these rides, has returned to earth—e-r-r, having given up his most recent meal, shall we say?

Like ball-players, these men have their "off-season" pursuits. Dick Grace, for instance, has gained no little fame as an author. Robinson, Phillips and White are also in demand as writers on occasion, as well as serving frequently as test pilots.

Bragunier has several aviation inventions to his credit; Batt and Mantz have made careers for themselves as business men, Batt holding the Southern California distributorship for Beechcrafts and Mantz operating one of the largest flying schools and charter services in the country.

Rankin holds all the exhibition flying titles for which he has ever competed. Tomick is much sought after as a test pilot and is considered one of the best men on the Pacific Coast for special flying jobs.

Invariably the question arises: Why do these ten superlative airmen stick to such a hazardous occupation? Certainly it can't be the pay—many former members of their company make more money in other fields. Can it be the exciting life before the cameras, the glamorous contacts, the salty tang of adventure that holds them?

Regardless of varying answers they might give to these questions, there is another outstanding characteristic of their company; the fine fellowship among them. They are all friends in the deepest meaning of the word. They have had hundreds of hours in the air together and have held hundreds of meetings to discuss flying problems and new "stunts"—and the knowledge of one belongs to all.

Arising from this close fellowship is the one major factor that has given them lordly confidence in themselves—when they take to the air for a difficult or dangerous scene, each pilot does so with complete trust and the certain knowledge that every other member of the group will fly strictly according to plan with split-second timing and consummate skill. Further, when an emergency arises, each pilot *knows* how the others will react—a comforting knowledge when his life hangs in the balance.

The Associated Motion Picture Pilots as an organization has existed since 1932, though several of its members have been risking their necks since the days of the Pearl White serials. Clarke, a mere stripling who hadn't yet learned to fly, was wing walking and doing plane changes in those days of the cinema's infancy.

After making "Hell's Angels," however, the pilots looked back at flying assignments that brought four deaths in their ranks—deaths caused, they say, because they were forced to fly unsafe equipment under impossible conditions for directors demanding risks too great.

They saw pilots—competent and incompetent—played against each other in their need for work and men asked to gamble their lives for ridiculously small pay . . . and they rebelled.

By forming a tight, well-disciplined organization they first saw to it that tyro

For Aviation Training Consider these Advantages

A Location on Roosevelt Field—the World's largest and busiest Civil Airport—a veritable City of Aviation—

WHERE 250 planes are permanently hangared and serviced;

WHERE there are 40 buildings devoted exclusively to the aircraft business;

WHERE 45 operators and their employees do everything from a minor repair to a complete overhaul;

WHERE aviation activity goes on 24 hours a day every day in the year;

WHERE every type of plane from everywhere comes for inspection and service. Eastern Divisional Headquarters are maintained here by the Bureau of Air Commerce for the licensing of planes, pilots and mechanics;

WHERE day classes only are taught. This eliminates the confusion that comes from day and night classes using the same equipment;

WHERE advanced students, under an Instructor's supervision, overhaul, repair and rebuild licensed planes of every type and put to practical use—on planes that must keep flying—the knowledge they have acquired;

WHERE there is a complete Faculty unsurpassed in aviation knowledge and experience;

WHERE each Instructor is a specialist in the subject he teaches;

WHERE an Advisory Board—composed of Leaders in the aviation industry and other fields—cooperate with the Faculty to the end that students are taught to do the same work they will be required to do later;

WHERE the methods applied mean that Roosevelt Students are properly trained and are acceptable—upon graduation—for employment by the industry.

WRITE TODAY
ADDRESS DEP'T P. A.

ROOSEVELT AVIATION SCHOOL
AT ROOSEVELT FIELD
MINEOLA, LONG ISLAND, NEW YORK

pilots were barred from the dangerous work and then enforced a demand that the airmen themselves approve and supervise all dangerous scenes. They established a set of pay rates covering all types of flying and other services and soon found themselves accepting the responsibility for the realism and authenticity of aviation scenes in motion pictures.

Collectively they studied not only flying but camera angles, scene values and production problems. They have become familiar with the industry's problems in making motion pictures as well as their own problems as pilots.

So ably have they functioned that today their association has a virtual monopoly on movie flying for the major studios of Hollywood and full responsibility for all aviation sequences. Studio executives rely upon them for flying, piloting camera planes, technical advice on a thousand and one subjects related to aviation and even, at times, the actual direction of aerial sequences.

The Associated Motion Picture Pilots as a result hold the respect, trust and good will of the entire motion picture industry. In turn they give the industry the realism, sincerity and authenticity that assured the success of such sky dramas as "Wings," "Dawn Patrol," "War Correspondent," "Sky Bride," "Air Mail," Devil Dogs of the Air," "Suzy," "Honeymoon Pilot," "China Clipper," "Lost Horizon," "Flight from Glory," and current pictures such as "Test Pilot" and "Men with Wings."

The pilots, after effecting their organization, combatted demands for excessive risks by simply refusing to accept them, standing firm as a group. Today they alone determine whether a stunt is possible of performance. They rarely fail to deliver. When they have refused a stunt, more often than not they have worked out an alternative that gave more dramatic value than the original scene could have.

The members took the same stand regarding the equipment they would fly. Where once a studio rounded up ancient planes and ordered the pilots to fly the creaking ruins, today the pilots themselves furnish the equipment. If an old plane is to be used, it is always rebuilt. Very few chances are taken here.

Another evil they uprooted was the re-issue of "stunt footage" to "stock shot" rental libraries serving the studios.

During the filming of "Hell's Angels," for instance, thousands of feet of the studendous aerial "dog-fight" above the clouds were "shot" from a score of camera planes. Only a fraction of it was used in the finished film. The rest was made available to "stock shot" libraries.

Perhaps the term "stock shot" is confusing. Every studio and several independent concerns has stored away pictures of far away or unusual scenes. The Shanghai waterfront—the pyramids in Egypt—a World War barrage—the opening of Parliament in London—the dance of natives in the African jungle and similar scenes.

Carefully preserved from news reels, travel films or costly location trips for other screen dramas, the stock shots are filed away for use again should the need arise. Studio stock shot libraries are usually carefully guarded; others make their negatives available to all comers for a price.

The "Hell's Angels" footage landed in libraries of the latter type—with the result that the movie pilots risked their lives for one film and saw their efforts in dozens of later releases.

Jerry Phillips, secretary of the Associated Motion Picture Pilots since the group's organization, combed Hollywood's statistical bureaus to estimate the thousands of dollars lost to the pilots in this fashion.

The figures proved astounding—and easily convinced the major producers that such re-issues of aerial scenes were unfairly cutting into income earned at tremendous risk.

Previously I have mentioned the careful planning that has become the most important part of the work of the Associated Motion Picture Pilots. Here are some of the details this planning involves:

Constant checking and re-checking with studio departments on "location" airports to see that they reproduce faithfully the appearance—down to the last detail—of the place it is to represent. This involves lengthy conferences with set builders, property department heads, research experts who dig into scores of files to bring out pictures showing, perhaps, the actual airport in South America or Europe where the scenes are laid; and with costume experts for authentic uniforms, ground crew coveralls and other attire.

A search for airplanes. If the picture is to show World War scenes actual war-time planes are sought or modern planes rebuilt to look like the old timers. In Hollywood there are scores of old planes still in flying condition, carefully preserved for studio use.

These steps, and they are infinitely more involved than can be shown in this hasty recapitulation, are preliminaries. The later preparations involve notification of association members next in line for work to meet, discuss their flying assignments and familiarize themselves with their airplanes.

The Associated Motion Picture Pilots know the danger of their work. They realize that the dangers increase with the number of air scenes in a film so they prepare for every move, every stunt with a care that amazes the lay observer—but often means the difference between a successful "thrill" and a foolhardy, dangerous and possibly fatal gyration of little camera value.

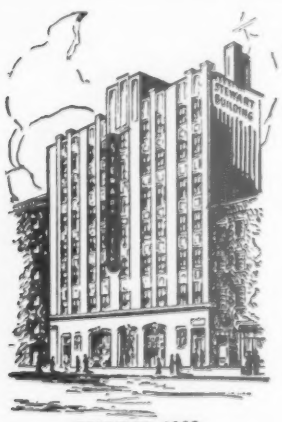
Planning every move means that there must be long sessions of diagramming maneuvers on a blackboard and then working them out with ten cent store model airplanes so each pilot may visualize the position of his plane with relation to the others and to the earth.

The last, final preparation before taking to the air for the cameras, especially for a scene in which several planes are to be in the air at once, is the rehearsal—actual performance, over and over, of the maneuver so that every turn may be accurately timed to the split second.

Then, when the camera planes are in the air, high cloud banks furnish backgrounds and the suicide crew takes off—they merely carry out a carefully considered, well-nigh faultless flight plan with the technical director as flight leader.

But when *you* see it—hang onto your seat, it'll make you dizzy!

END



FOUNDED 1909

AVIATION TRAINING

at STEWART TECH

The following courses are offered: 1. Aircraft Mechanics. 2. Aircraft Sheet Metal. 3. Aircraft and Diesel Engines. 4. Aircraft Radio. 5. Aeronautical Drafting and Design (Applied Engineering). Stewart Tech Graduates are eligible to make application and take the test for Government Licenses.

Stewart Tech training is backed by 28 years' experience. Get your training in New York City—where you can use your spare time to great advantage at hundreds of places of educational interest—a liberal education in itself. Tuition payments may be arranged on a weekly or monthly basis. Descriptive catalog free. Call or write the

AVIATION DIVISION

STEWART TECHNICAL SCHOOL

Dept. 125 Stewart Tech Building, 253-5-7 West 64th St., N. Y. C.

Approved by Bureau of Air Commerce as an

AIRPLANE AND ENGINE MECHANIC'S SCHOOL

HOME OF THE DAWN PATROL

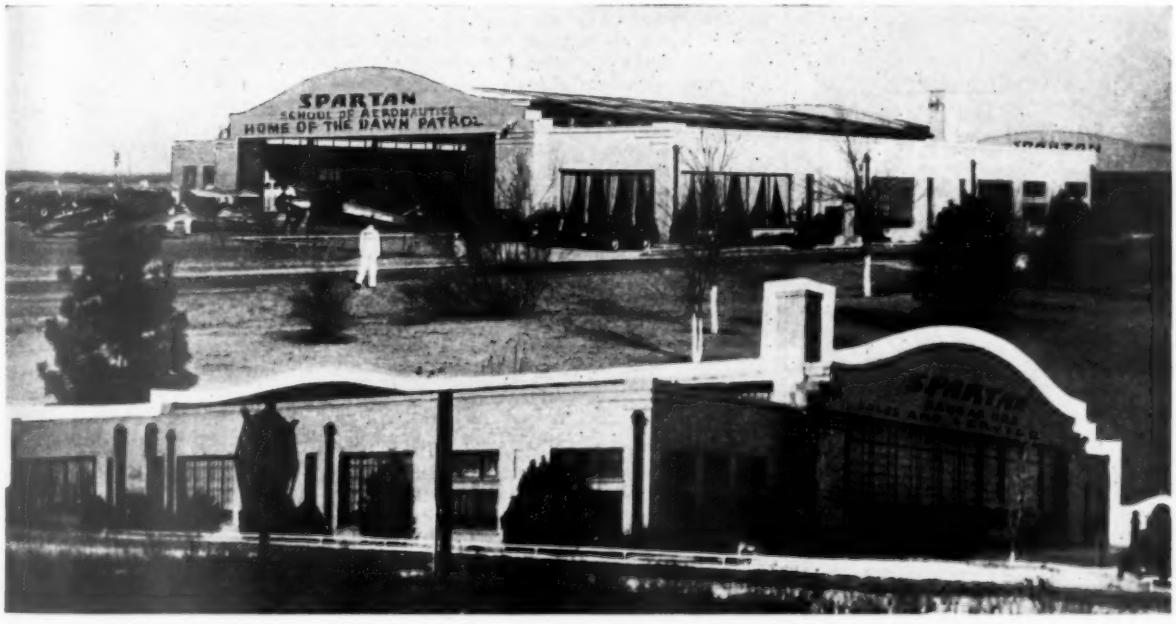
NEW HANGAR

SPARTAN AGAIN Increases FACILITIES

Adds 40,000 square feet—
giving Spartan two of the finest, most modern fireproof hangars in the country.

NEW FLYING EQUIPMENT— added personnel, to maintain Spartan training standards.

With the largest enrollment in the history of the school—with students recently enrolled from Portugal, China, Puerto Rico, Costa Rica, Philippines, Cuba, Venezuela, Colombia, Peru and Mexico—and with the demand for trained personnel the greatest in Aviation history—



SPARTAN
SCHOOL OF AERONAUTICS

Spartan has added over 40,000 square feet of additional floor space to be devoted to advanced class rooms, Radio, Sheet Metal, Advanced Engine Shops and School Stock Rooms, enlarged Machine Shops, Assembly Plant and Parachute Rooms. In addition to complete housing of Primary Class Rooms, Spartan maintains its own Restaurant, two Dormitories and the school's own 240 acre practice field. These are the facilities that assure you a future in Aviation through the TRAINING Spartan Courses afford. Write for information now.

DISTRIBUTORS Eastern Oklahoma for the TAYLORCRAFT Airplane. APPROVED REPAIR STATION NO. 50

Address DEPT. PA4, P. O. BOX 2649
TULSA, OKLAHOMA

SPARTAN COURSES OFFER—*The Fastest and Most Economical Method of Entering the Industry*

FIRST IN ITS FIELD

FOR more than ten years, POPULAR AVIATION has lived up to its name by being popular in all branches of the industry. It appeals to the experienced pilot, executive and layman alike.

For $2.50, you will receive this most interesting magazine for one year. Subscribe now!

POPULAR AVIATION
608 S. Dearborn St. Chicago, Ill.

BIG MONEY
ASSEMBLING NEW
BOAT
In a Few Days
At Home
$6 PADDLE
GIVEN
with your CR.Ki-Yak—if you hurry!
Make big money on each 20 lb. Mead Ki-Yak you easily assemble at home from complete cut-to-fit kit at amazing Low Factory Price! Portable. Seaworthy. Fast! 3 Ki-Yak sizes for paddling or sailing—2 OUTBOARD KI-YAK models for rowing, sailing, motor up to 8 h.p.). Patented aluminum-ribbed construction guarantees successful, quick, beautiful job.
RUSH 10c for illustrated folder and $6 Paddle Gift Offer!
MEAD GLIDERS, 15 S. Market, Dept. E-58, CHICAGO, U.S.A.

***Win Meets*—BE A CHAMPION**

The strongest competition in the world has definitely established the Baby Cyclone as undisputed World's Champion. In 1937 it won the championship of the United States, France, Germany and England.

A BETTER ENGINE FOR LESS MONEY . . . HERE'S HOW WE SAVE YOU MONEY: The very finest materials, high precision skilled workmanship and rigid test inspection required in its manufacture make the Baby Cyclone very expensive to build. To add usual dealer's discount to cost of manufacture would cause this engine to sell for $25.00. Instead Aircraft Industries now sells only direct from factory to user thus passing the dealer's discount on to you as a big saving. You thus can buy the best and most expensive engine at the cheapest price. It has proven that it can win for others and it can win for you. Win meets! Be a Champion! Order your Baby Cyclone today . . . right now.

EVERY ENGINE BLOCK IS BLOCK TESTED AND GIVEN FULL THROTTLE RUN BY THE FACTORY EXPERTS BEFORE SHIPMENT TO INSURE PERFECTION
"CYCLONE SERVICE"—Your engine positively will be shipped same day order is received
PRICE IN ALL FOREIGN COUNTRIES EXCEPT CANADA $25.00

ORDER BLANK
AIRCRAFT INDUSTRIES • GRAND CENTRAL AIR TERMINAL
GLENDALE (LOS ANGELES) CALIFORNIA
I Enclose P. O. Money Order for Items Checked
◯ BABY CYCLONE ENGINE MODEL "E" . . . $12.50
◯ CALIFORNIA "Champ" Kit Complete $10.00 ◯ CALIFORNIA "Chief" Kit Complete $7.90 ◯ HARDWOOD PROPELLER $1.50
◯ COMBINATION "Champ" Kit, propeller and engine $17.85 ◯ COMBINATION "Chief" Kit, propeller and engine $15.75
SHIP TO _____ Age _____
ADDRESS _____ FA-5

Home on Sealskin

(*Continued from page 27*)

must be found. Canvas was obtained from the Hudson's Bay post at Eskimo Point and the work went on. During the night the tide came in and the floats filled with water. The patches loosened and proved to be useless.

Buchanan's gang wasn't discouraged. They'd been through too many tough northern jobs to let a little thing like that worry them. They dug their trenches again and went to work as soon as the tide went out. For three days they worked and at last the job was finished as well as could be expected. Then another discovery was made. They would have to dig trenches through the rocky foreshore in order to get their ship into the water.

Even as they started to dig, the tide came in. The big ship floated, then bobbed up and down, but there was not enough water to carry it out into the bay. When the tide went out again, the ship came down on sharp rocks which cut the canvas patching again. Once more the indomitable crew went to work.

This time they covered the holes again with canvas. They got their ship into deep water. Buchanan went aboard and started the engine. After waiting a time for it to warm he headed out into the bay for the take-off.

But there was to be no take-off. The canvas could not stand the water pressure and it bellied out like a balloon behind the floats. Buchanan felt his ship grow loggy. He kept his gun wide open and headed for the beach. Only the great lifting power of her giant wings kept the Junkers afloat until she was beached.

By now it was fairly well admitted that canvas as a patching material left much to be desired. Nine heartbreaking days had been spent in patching the floats and they were now as bad as ever—and the weather was getting bitterly cold. Something must be done at once. The ship and crew were 850 miles north of the home port.

Someone suggested using sealskin, the same material used by Eskimos in making their tight little kayaks (hunting boats). Buchanan was willing to try anything. He decided to leave the hole made by the boulder open and concentrate on getting the others tight.

The tough, waterproof skin of seals was pressed into service. It was stretched over the holes and fastened in place by thongs, then the hole was covered with pitch. Bracing boards was placed behind each patch inside the float. At high tide, Buchanan taxied out into the Bay and shoved his gun wide open. It was now or never.

The big ship wallowed along, her floats rapidly filling with water. A high wind was blowing and when all hands ashore seemed agreed she could not get off, she took the air. It was estimated that two tons of water were carried aloft in her damaged floats. When she stopped at Le Pas, Manitoba, for fuel it was necessary to have fire pumps at the dock to keep her floats dry until she was ready to leave.

She did get away, however, and returned to Winnipeg, where she was drawn up on the ramp. Her floats were removed and it was shown that where sealskin had been used, the compartments were fairly watertight. Thus was a valuable airplane saved by Eskimo materials and the indomitable will of its hardy crew.

Instances like this are typical of northern flying. Ripley would have a fine time in the north country.

Another Junkers aircraft, B-K, has also had her share of tough breaks. She made a sweet landing far up in the Cariboo then hit a fence that was hidden by snow. Makeshift repairs brought her home.

Yes, you have to have ingenuity if you want to fly in the north country and you have to have it all for $130 per month and three cents per mile. If you like this and can stomach 60-below weather during the winter and ten million black flies to the square yard during the short summer then go north, young man, go north.

END

Mailman Overboard

(*Continued from page 26*)

general store, a Mr. Thompson, who stated that his neighbor had heard the plane crash but could only guess at its general direction.

I rode with Mr. Thompson to his farm and after leaving the parachute in his house we canvassed the neighbors for any information concerning the plane. After searching for over an hour without results I left instructions to place a guard over the mail in case it was found before I returned and went to Chicago for another ship.

On arriving over Covell the next morning I found the wreck with a small crowd gathered around it less than 500 ft. back of the house where I had left the parachute. The nose and wheels had struck the ground at about the same time and after sliding along for about 75 ft. it had piled up in a pasture beside a hedge fence. One wheel had come off and was standing inflated against the wall on the inside of a hog house a hundred yards farther on. It had gone through two fences and the wall of the house. The wings were badly splintered but the tubular fuselage, although badly bent in places, held its general form even in the mailpit. The parachute from the flare was hanging on the tailskid.

There were three sacks of mail in the plane. One, a full bag, from St. Louis had been split open and some of the mail oil soaked but legible. The other two were only partially full and were undamaged.

I delivered the mail to Maywood by plane to be dispatched on the next ships out.

END

BREAKING air records has been almost a daily occurrence since two American brothers in 1903 set the first record of all by actually flying 120 feet in 12 seconds.

Their 12-horsepower engine wouldn't even turn over the "prop" on a big airliner of today. Yet in that tiny motor was the secret of the first successful powered flight, and the secret of similar records since — *gasoline!*

Gasoline gave aviation its first practical power-weight ratio—a ratio that lifted a heavier-than-air craft off the ground and sustained it in flight.

In the 35 years since Kitty Hawk, hundreds of air records for speed, endurance, altitude and distance have been made and broken. Every new record has faithfully reflected the continuous advance in fuels and engines.

The end is not yet. Today, advancement in aviation still depends on the inseparably linked fuel and engine. To make the next 35 years as significant as the past 35, Ethyl engineers are cooperating with aviation engineers in a continuous program for the improvement of fuels and engines. Ethyl Gasoline Corporation, Chrysler Bldg., New York, N. Y.

Curtiss
A-18
Fastest
ATTACK PLANES
of the
U.S. ARMY

The Curtiss A-18 all-metal, twin-engined monoplane, with retractable landing gear, is the fastest Attack airplane of the United State Army Air Corps.

Equipped with Curtiss Constant Speed "Feathering" propellers and powered by 1000 H.P. Wright Cyclone engines, the A-18 is designed primarily for use in low altitude attack fighting or light bombardment.

Planes of this type have recently been delivered to the U. S. Army Air Corps and are now rendering important service duty under the United States Government's program of building up an adequate Air Force for National Defense.

"The Pioneers of Aviation"

CURTISS-WRIGHT CORPORATION
CURTISS AEROPLANE DIVISION
BUFFALO · NEW YORK

Trans-Atlantic Wings

(*Continued from page* 16)

These survey flights resulted in the accumulation of a great amount of data as to operating conditions and requirements and contributed much to airline and personnel training. They cleared the stage for the drama now about to be unfolded.

The information collected concerning weather and marine conditions, radio operation and navigation problems has been the subject of studies all through the past Winter and of extensive engineering research looking toward further survey flights, should it be determined they are needed, and toward regular service.

The survey flights also served to sketch pretty well the routes which are likely to be flown in regular service. For Pan American-Imperial there are two major routes—a northern from Botwood, Newfoundland, to Foynes, Ireland; a southern via Bermuda, the Azores and Portugal. They probably will serve as alternate Summer and Winter routes. The Germans and French, barred from Bermuda, favored the Portugal-Azores-United States path.

Much of the drama of the trans-Atlantic pioneering, oddly enough, was due to the fact that there was so little of the dramatic and so much of the routine in the manner in which it was tackled by the seasoned Pan Am ocean flight crews. Capt. Harold E. Gray, before take-off laid out his flight plan, announced his estimated flight time and, on the first two trips, hit it within three minutes each time! He reported the flight as "uneventful", rather to the chagrin of a horde of avid reporters who met him.

Even the flight menus illustrated the vast difference between this prosaic pioneering and that of the days when heroes set out with a couple of sandwiches and a thermos bottle to find Glory or Death. The Clipper flying officers sat down at a table quite properly set with shiny china and complete silver service. As they pioneered blithely they ate fresh shrimp cocktail; celery and olives; broiled double spring lamb chops done to a turn, with fresh broccoli and butter sauce; creamy mashed potatoes; fresh rolls and creamery butter; fresh tomato salad with Thousand Island dressing; assorted French pastries for dessert; coffee; iced tea and individual services of mixed French chocolates and after dinner mints. Ah, the hardships of pioneering!

With the advent of Summer it is to be expected that there will be a revival of activity at frozen Botwood. The cold season drove the Bermuda - United States base south from Port Washington to Baltimore and a third base is being prepared at Charleston, S. C., just in case the open waters at Baltimore should become ice-locked. The Botwood base, hewn out of the wilderness, is expected to serve as the "jumping-off place" for the Summer flights to Europe. With this as the west-bound terminal, the British will establish connections with the Canadian airlines; the American with our own domestic system. It is possible that the ocean airliners themselves may span the gap between New York and Botwood.

Although the British and American services are referred to as a joint enterprise, this, strictly, is not entirely accurate. They share the same bases, radio stations and weather service. The flights themselves, however, are independent, national affairs. And, although the lines of course freely exchange information and flight data, their flight programs are separate, even though synchronized as to schedules.

Pan American Airways also has cooperative understandings, also of long standing, with Lufthansa and Air France Transatlantique and expects to establish a similar system of sharing of facilities and possibly of exactly parallel operations. There was to some extent a sharing of facilities during the survey work of last Summer. The German mothership, *Schwabenland*, for example, provided radio bearings for the *Pan American Clipper* en route to the Azores, as well as to the German seaplanes.

Air France also had a floating weather and radio base in mid-Atlantic. The *S. S. Carimare*, under charter to the airline, made possible a long study of ocean weather during the Summer and assisted the flight of the huge French survey flying boat, *Lieutenant de Vaisseau Paris*. Special attention was given to upper-air winds by a staff of ten French meteorologists and reports were radioed daily to Port Washington and to Air France stations in Europe.

As a result of all this cooperation, even though the ultimate services to a large degree will be keenly competitive the survey flight season of last year was highly successful. By mid-October, the British, German and American survey planes had rolled up a total of 85,000 flight miles in 23 Atlantic crossings. All courses likely to be used were flown; the northern seven times in both directions; the middle area four times, and the southern once each way. There were only minor hold-ups, the British *Caledonia* being delayed one day in Ireland by weather and the *Cambria* damaging a pontoon, resulting in a slight delay. Before the season closed, both German and French mileage was added to the total with equally little fuss and excitement.

Now, a word as to the airliners of tomorrow's transatlantic service. The ultimate at present in sight is the giant contemplated in the Pan American bid to manufacturers in December. The "specifications" called for an aircraft with a payload capacity of 25,000 pounds and a range of 5,000 miles in still air at cruising speeds of not less than 200

m.p.h. at sea level. The "sea level" figure was interpreted to mean something in the neighborhood of 233 m.p.h. at normal flight levels and up to 299 m.p.h. at altitude.

These aircraft were to provide stateroom accommodations for at least 100 passengers, with dressing rooms, dining room and galley, having adequate facilities for the preparation and storage of food. Crew accommodations were to allow for a crew of 16 and cargo compartments were to be provided for mail, baggage and express sufficient to permit full use of all payload capacity not utilized by passengers.

Manufacturers were called upon to submit proposals for construction and equipment of three, six or twelves such aircraft, with options on lots of three, six and twelve additional. The project, it was pointed out, was put squarely up to the manufacturers, with no restrictions as to type of airplane. There was one illuminating point, however: "Special consideration will be given to designs which incorporate features permitting operation of the airplanes at 20,000 feet altitude or higher with interior cabin pressures equivalent to 8,000 feet altitude."

This is a key to the anticipated future of long-range ocean operations. Pan Am now has under contract at the Boeing plant two airplanes, *Stratosphere I* and *Stratosphere II*, which are built to the same altitude specifications.

Officials of Pan Am have declined to hazard any guesses as to such probable dimensions as wing span, over-all length, gross weight or number and horsepower of engines for the new giants. They will, however, it was pointed out, be ten times the load size of the *China Clipper* type. And it was pointed out that few steamships, aside from the big passenger liners, have accommodations for 100 first class passengers.

Second in point of size are the "super Clipper Ships" now under construction by Boeing for Pan American. The Wright Aeronautical Corporation has developed for these airplanes a new 1,500 h.p. engine, 26 of which have been ordered by Pan Am for the Boeings. Orders for the airplanes themselves were placed secretly two years ago following the international conference in Washington at which understandings were reached between the United States and Great Britain for establishment of trans-Atlantic air service.

The Boeings will have four of these engines, turning out 6,000 h.p., and the "all-up" weight is expected to be between 40 and 50 tons. They are to have capacity for 72 passengers and crew of eight, with cargo holds for 5,000 pounds of cargo. Speed, it was estimated, would be close to 200 m.p.h.

These boats have three decks. The flight deck, with posts for six flying officers, is located on the top deck, beneath the wing. Back of the bridge and the captain's compartment, inside the wing itself, are sleeping and living quarters for the crew, including a separate galley. Aft of the officers' quarters is a cargo compartment larger than the cabin on the run of present overland transports.

Running the length of the ship, beneath the flight deck, is the main deck, on which the passenger cabins are located. These will include, in addition to regular cabins, private staterooms both fore and aft, and a dining and lounge cabin. Forward on this deck is the galley, with all facilities for cooking. Hot and cold running water will be available throughout the ship.

The third deck, or hold, will provide space for cargo, in a series of perfectly water-tight compartments running the length of the ship. Fuel tanks for a normal supply of 5,000 gallons, or 15 tons, of gasoline, are located in the wings and sponsons.

The Martin "156," known as the "Martin Ocean Transport," first of which has been shipped to the Soviets, is a 63,000-pound, four-engined monoplane, powered with Wright *Cyclones*. Normal passenger load is 46 on day flights and 26 at night, in individual berths. The "156" is claimed to show a gain of 285 per cent in long range payload transport efficiency as compared with the *China Clipper* type, also built by Martin, on the basis of the 2,410-mile route from San Francisco to Hawaii. The "156" has a span of 157 feet, overall length of 91 feet 10 inches and overall height, on beaching gear, of 27 feet 2 inches. The hull has a beam of 11 feet 3 inches.

Disposable load is given at 32,586 pounds and payload 30,458 pounds. Top speed is given as nearly 200 m.p.h.; cruising speed at 145 to 170 m.p.h. and landing speed with normal gross load, 70 m.p.h. or less. Thus, the Martin "156," without overloading, is capable of taking off and cruisiing with a useful load more than equal to its own empty weight.

Inauguration of trans-Atlantic service will complete the extension of the United States system halfway around the globe and will establish it indisputably as one of the world's foremost civil air powers.

The story to be written in the skies over the Atlantic will be one not only of aeronautical progress but of the development of industrial and commercial interests as well. It will be the culmination of preliminary work which already was well advanced in July, 1933, when Col. Charles A. Lindbergh, in his capacity as technical adviser to Pan Am, with Mrs. Lindbergh, made their historic "survey circle" of the North Atlantic.

Field expeditions, five in all, went into Greenland and Iceland to study weather conditions. Studies were made along the main steamer routes. Technically and from an organizational standpoint, Pan American was prepared to establish an airline across the Atlantic in 1935, when it set up its Pacific operation. All that was lacking then was the interchange of landing privileges in the North Atlantic.

Now the stage is fully set, the actors are in the wings awaiting their cues. . . Up curtain!

END

Do You Know...

. . . THAT 1000 H.P. Wright Cyclone engines powered the six four-engined Boeing "Flying Fortress" B-17 Bombers of the U. S. Army Air Corps which recently completed a 12,000 mile "good-will" flight from Langley Field, Virginia, to Buenos Aires, Argentina, and return to represent the United States at the inauguration exercises of President-elect Roberto Ortiz.

. . . THAT this flight was commanded by Lieutenant Colonel Robert E. Olds of the U. S. Army Air Corps. The trip from Miami to Buenos Aires was made in 27 hours flying time with only one stop—Lima, Peru—after leaving the United States.

. . . THAT the entire 12,000 mile flight was accomplished in approximately 66 hours of flying time—an outstanding achievement of the U. S. Army Air Corps.

. . THAT the towering peaks of the South American Andes were no obstacle to the Boeing "Flying Fortresses" because their Cyclone engines were equipped with new "two-speed" superchargers which, in effect, provided them with the performance characteristics which previously would have been possible to attain only if two distinct sets of power plants were installed. In other words, each Wright Cyclone equipped with this device is virtually "two-engines-in-one".

. . . THAT despite long hours of continuous running in temperatures ranging from minus 10° to plus 40° centigrade, operation at altitudes ranging from sea level to 22,000 feet, flight during day and night through overcasts on instruments, and a severe dust storm over the Pampas in Argentina, all 24 Wright Cyclone engines operated perfectly through the entire flight.

. . . THAT Wright Cyclones also power many other types of U. S. Army and U. S. Navy aircraft as well as all of the high-speed luxurious Douglas Day planes and Sleeper planes now in service on American Airlines, Eastern Air Lines, Braniff Airways, Transcontinental & Western Air, Pan American Airways System and many other leading airlines throughout the world

"Fly with Wright the World Over"

WRIGHT

AERONAUTICAL CORPORATION
PATERSON NEW JERSEY

A DIVISION OF CURTIS-WRIGHT CORPORATION

How's the Weather?

(*Continued from page* 56)

Assume, for example, that we are making observations in Washington, D. C., on the day for which the map in Figure 1 has been made. As the low over the central regions moves eastward the air pressure will gradually fall. This will be evidenced by the falling barometer at Washington. As the imaginary isobaric lines cross our point of observation on their way eastward the barometer will fall to 29.8, 29.7, 29.6 and, as the center of the low reaches us, it will record under 29.5 inches. From that time onward it will rise as the low moves off to sea and the air pressure increases with the coming of the mountain of air—the high. The cloudy weather in advance of the low will be succeeded by rain and then by clearing weather as the low center passes. The winds, which will have been southeasterly in advance of the storm, will shift to the northwest as it passes.

It is this method, with intricate variations, that weather-men have used to forecast conditions. They followed the pressure areas across the countries and oceans, estimating the time of arrival at important points and thus predicting weather conditions based upon the positions of lows and highs. Were the movements of these areas and the changes in weather as simple as those just described there would be little need for the meteorologist. But it so happens that lows seem to materialize out of nowhere, dash across the tops of mountains, retrograde westward or do a dozen other things to turn the weather-man's head gray. Yet the Weather Bureau has been able to maintain a high percentage of accuracy in the face of the unpredictable vagaries of Mother Nature. The period during which the foregoing method of forecasting was employed may be called the "pre-frontal" era. Why will soon become evident.

The Polar Front Theory

The system of forecasting which employs a weather map of the type we have just studied, and which depends for its accuracy on the movement of low and high pressure areas, has a decidedly limited scope and certain setbacks. One disadvantage was forcibly made clear during the World War. Since observations from important points in Germany and Austria were missing, the Allied meteorologists could not construct a full-sized map. Movements of one pressure area are hinged to the movement of others in the vicinity, and since our weather-men did not know what was going on across the Rhine and on the other side of the Alps, the weather maps weren't of much practical use.

At this crucial period the Norwegian meteorologists came to the rescue with a method which they had under development for some time. The leaders of this new science were V. Bjerknes—the father and mathematician; and J. Bjerknes—the son who put the theories to practical test. They brought into play a new line of reasoning which was to become to meteorology what the telescope was to astronomy. They called this new science the "polar front theory".

In its essentials, it postulates that an imaginary line can be drawn around the world which would roughly divide the cold air of polar regions from the warm air of the tropics. This line changes its position constantly. When the cold polar air pushes southward the line enclosing the moving mass and separating it from the warmer air to the south is called the polar front or cold front. When the warm air forces itself northward against the cold stream the dividing line between the warm and cold masses is called the tropical, or warm front. When the cold front pushes itself southward through a point of observation, the wind at that point shifts from a southerly direction to a northerly one and the temperature drops precipitately. When a warm front moves northward through a station, the wind shifts from northerly to southerly and the temperature rises rapidly. The Bjerknes' also stated that on this dividing line or front, disturbances developed which moved along the front in an easterly direction—exactly the same as if you fastened one end of a rope and, holding the other end fairly tight, gave it a jerk. We all know what happens—a wave begins at the hand and travels along the rope in the form of a hump. If we formed a big wave, by moving the hand a greater distance up and down, the wave moved faster. If we gave it a quick, short jerk a high short wave would form which would move slowly along the rope. The wave disturbances which are formed on a front are similar to these rope waves.

The wave disturbance portion of the theory is illustrated in Figure 2. The heavy solid line (1a) represents the polar front with cold winds to the north and warm winds to the south—flowing in opposite directions. If an impulse (from any number of things) is given to the polar front a slight bend (the hump in the rope) develops (1b) and the warm air, which has previously been in stable equilibrium with the cold air, begins to slide up over the colder polar air mass. Now, as we know, if we take a volume of air and raise it to high levels, it expands in volume because the pressure at higher levels is less than at the ground. When it expands it cools, and soon a point is reached when the cooled air cannot hold the moisture it once did at the higher temperatures prevailing at the ground. The excess moisture then becomes evident as clouds, and if the cooling is rapid enough, rain falls. That is exactly what is happening in (1b) as the warmer air begins its climb over the colder mass. The shaded portion represents the area over which rain is falling due to the ascending air.

It is this stage of weather which bothered "pre-frontal era" meteorologists most. There was nothing in the books of that day which could throw any light on how a low (or disturbance) actually developed. There were numerous theories, but until the Norwegians came along no one even guessed at the solution which was actually under our noses all the time.

The fully developed wave disturbance is shown in (1c). The warm air has made a deep intrusion into the cold stream. The cold polar air is circling around the western side of the wave and the cold front is marked by the solid line. The

FOSTER A. LANE
PORT COLUMBUS FLYING SCHOOL
ADDS THE NEW LAMBERT POWERED
➽D-A-R-T→ To Its Line-Up
*PRACTICAL COURSES
COMMERCIAL FLYING Courses
Private Flying Courses
Ground School Training
*EQUIPMENT
DART—Lambert
Ryan—Monasco
Waco—Wright J5
Beechcraft—Jacobs
Taylorcraft—Cont.
CUB—Continental
*Special Courses
Aerial Advertising
Aerial Photography
Operator's Business Course
The Practical school of practical Flying that will assure your future in Aviation. For information write to,
FOSTER A. LANE
PORT COLUMBUS FLYING SCHOOL
Based in the Dart Manufacturing Corp. Hangar
PORT COLUMBUS COLUMBUS, OHIO

double light line represents the advancing front of warm air—the warm front. The rain area extending to the north belongs to the warm front and is caused by the warm air climbing over the cold. Behind the cold front is a narrow strip of rain. This has been caused by the cold polar air forcing the warm air aloft. The cold mass under-runs the warmer air in the form of a wedge, as we shall see later.

The final stage of the disturbance is represented in (1d). The cold front has overtaken the warm front near the center and in this particular instance has done two things: isolated a portion of warm air near the top of the wave; and has forced the warm air bodily off the ground at the point where the two fronts touch. The latter process is called occlusion and when this stage is reached the wave generally begins to dissipate.

One of the important things which the new theory has brought out is that nearly all waves go through the identical stages as shown in Figure 2. It seems that the ultimate aim of these waves is to develop into perfectly symmetrical whirls, indications of which are shown in (1d). In fact, these waves closely resemble the whirlpools formed in the backwaters of rapid currents or on the lee side of obstructions in water currents. Photographs of the air stream over an airfoil which has been inclined to nearly the stalling angle show a striking similarity to a fully developed wave circulation.

A good mental picture of what these disturbances look like is necessary for the complete understanding of how they work. Figure 3 is a vertical cross-section through the atmosphere of a typical cold front. It will be noted that the cold, heavier air moves along in the shape of a wedge, cutting in under the warmer, and hence lighter air. This action forces the warmer mass aloft and when the point is reached where the cooling is great enough to condense the moisture, clouds are formed and the excess moisture falls as rain or snow, depending on the temperature. In the summer the release of energy caused by the passage of a cold front is so great that enormous clouds, thunderheads, are formed with resultant squalls and severe thunderstorms. The peculiar shape of the nose of the cold front is due to the drag of friction near the ground which holds back the air at the surface while the front forges slightly ahead aloft.

The warm front is illustrated in Figure 4. The section shows the discontinuity—the line separating the warm and cold air—sloping upward from the ground to a height of thirty odd kilometers. The warm air from the left is sliding up the slope of cold air, forming heavy clouds and rain near the surface where there is greater moisture and only thin cirrus type clouds higher up where there is little moisture.

When the cold front catches up with the warm front as in Figure 2, the warm air is occluded, or cradled between the old cold air ahead of it and the new cold air behind it. The phenomenon is illustrated in Figure 5. The process by which clouds and precipitation is formed is much the same as that of the cold front. As the colder front pushes further and further into the old cold air the warmer mass is forced higher and higher until there is practically no moisture left and the significance of the occlusion as a factor in the weather disappears.

Types of Air Masses

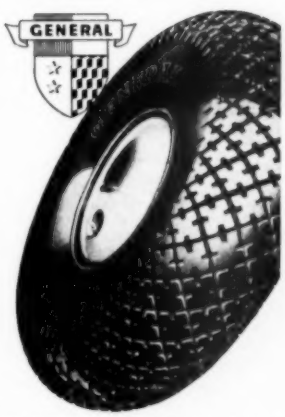
It is now time to pay some attention to the method which meteorologists use to distinguish one type of air from another. Air which exists for any length of time under certain environments acquires the characteristics of those environments which make it comparatively easy to identify even though that air travels thousands of miles from its point of origin. For example air which stagnates over the polar regions will obviously have certain characteristics (coldness and dryness) which would make it easy to distinguish from air which had lain for a long time over the South Atlantic ocean (warm and humid).

Temperature is one of the characteristics which is used to identify air. It is not, however, the temperature that we are used to dealing with every day. It is called potential temperature. Assume that a particle of air leaves the Gulf of

TRAVEL WITH SPEED, COMFORT AND ECONOMY . . . ON THE AIRLINES

• Dependable Generals play an important role in maintaining flying schedules. They do their part to keep operating costs low, which is reflected in passenger fares.

• Generals have made millions of airline landings and take-offs. Look for them when you travel by air. Generals are your assurance that the airline has an eye for quality in all its equipment.



GENERAL TIRE & RUBBER CO.
AKRON • OHIO

GENERAL Airplane Tires
KNOWN ROUND THE WORLD FOR SAFETY !

SPRING SALE

EVERYTHING DRASTICALLY REDUCED FOR IMMEDIATE CLEARANCE

WHITE GABARDINE HELMET
A dandy helmet for warm weather. Favored by autoists, aviators, cyclists and sportsmen. Strongly constructed to assure long wear. Has the conventional goggle straps and snugly fitting chin straps and pockets for ear muffs. Out they go at only..... **98c**

WHITE LEATHEROID REGULATION HELMET
A real buy for the particular sportsman. Popular among stunt-men and race drivers. Only a few left at this price..... **$2.89**

N.C. 8 STRAPLESS HELMET
Latest innovation in helmets. No rubbing, chafing or tugging. Concealed bands hold helmet snugly to head. Absolutely WIND-PROOF. Expertly tailored. Out they go. Each..... **$2.49**

FOREST GREEN GABARDINE HELMET
Waterproofed. Taped and sewed together. Sewed-in ear puffs. Built for real wear and tear. Can't be beat at..... **98c**

IMPORTANT
In ordering helmets, please state whether small, medium, or large size is desired.

D.E.C. GOGGLES
Trimmed with fur. Comfortably warm. Wide vision. Non-shatterable lenses. The last 4 pair priced especially for clearance. Each..... **$2.89**

W.Y.D. GOGGLES
Lightweight sport type. Strong frame. Wide elastic headband. Help us clear them at the amazingly low price of..... **$1.69**

W.Y.D.M. GOGGLES
The finest all-around goggle. Resistal non-shatterable lenses. Limited supply. Only..... **$2.49**

N.M.R GOGGLES
Widely used by pilots, students, and sportsmen everywhere. Soft rubber WIND-PROOF mask. Will not fog. Slashed to..... **$3.23**

D.E.K. GOGGLES
Lightweight aluminum frame. Easy to wear. Silk Chenille binding. Wide vision. Only 4 pair left. A real buy. Each..... **$2.89**

ENN BEE (5) GOGGLES
Bound with sponge rubber. Large clear lenses in a comfortable fitting and ventilated frame. A few left. Order right now..... **$3.43**

AMERICAN DETECTIVE GOGGLES
Ground circular removable lenses. Rubber cushioned and ventilated frame. Adjustable nose strap. Sacrificed at..... **98c**

OX-5 PISTON ASH TRAYS
Just the thing for your den. Hold plenty of ashes—saves constant emptying. Each..... **85c**

AERIAL BOMBS
Get one of these aerial bombs for your den or clubroom, and add real atmosphere to your place. Only..... **$4.75**

THIS COUPON WILL SAVE YOU TIME AND MONEY!

Fill it out and send it RIGHT AWAY

AVIATION PRODUCTS CO.
619 S. Federal St.
Chicago, Illinois

Please send the following to me immediately!

....

....

....

I enclose $..... to cover cost of this purchase. ☐ Enclosed find $1.00 deposit. Balance C.O.D. plus slight postal charge.

Name .....

Address .....

City ..... State .....
(be sure to print clearly)

Mexico at a temperature of 70° F. and slides up a warm front slope which extends northward to the Ohio valley. Now suppose that this particle, when it reaches the Ohio valley has climbed to an elevation of 10,000 feet. The temperature will no longer be 70° but probably nearer 40°. So you see it would do no good to try to identify the warm Gulf air by noting its temperature at 10,000 feet. The meteorologist takes the particle at 40° and brings it down, mathematically of course, to earth level again. In other words, he reduces all temperatures, at whatever height they are taken, to a standard pressure of 1,000 millibars. If the particle which had a temperature of 40° were at a pressure of 500 millibars at 10,000 feet he would bring it to a pressure of 1000 millibars with the aid of a diagram called the adiabatic chart. Thus a particle having a potential temperture of 70° will have that same potential temperature, no matter if you lift it to the stratosphere or sink it into the coal mines of Pennsylvania. Thus we have one unvarying characteristic to help us find out where a particular mass of air came from.

The other identifying characteristic is called the mixing ratio. Air can hold varying quantities of moisture, depending on the temperature. For example, if we take a cubic foot of air at 30° and raise its temperature to 70° the space required by the air at the increased temperature will be increased by many cubic feet. Now, just as a large vessel can hold more water than a smaller one, so can air at 70° hold more moisture than it can at 30°. The air, however, is not always saturated with moisture. On the contrary, it is more often dry than saturated. The mixing ratio is then, the quantity of moisture present in a given quantity of air. It is measured in grams of water vapor per kilogram of air.

The Rossby Diagram

Dr. C. G. Rossby of Massachusetts Institute of Technology devised a graphical method whereby these two characteristics of air, potential temperature and mixing ratio, could be used to identify air types. Figure 6 is a simplified form of what meteorologists call the Rossby Diagram. The vertical scale is potential temperature in degrees absolute (obtained by adding 273 to the Centigrade temperature) and the horizontal scale is the mixing ratio in grams per kilogram.

The curve at the top of the diagram (marked Tg) was made at Dallas, Texas, on a summer day in what is called tropical gulf air. In other words the air originated in the Gulf of Mexico. On that day an airplane carrying temperature and humidity instruments went up to a height of about 17,000 feet. When the record was brought to the meteorologist he calculated the potential temperatures and mixing ratios and the curved marked Tg was the result. Note that the potential temperature at the surface (S) is about 300° and the mixing ratio 13.5 grams. Contrast the warmth and moisture content with the surface characteristics of the curve in the lower left hand corner marked Pc (polar continental—from the polar regions of North America) which was made at Fargo, N. D. At this latter station the potential temperature is about 252° and the mixing ratio less than one gram. In the former case the tropical gulf air has acquired warmth and moisture from the Gulf of Mexico; in the latter case the polar air has acquired its extreme cold and low moisture content from the cold northern regions. It most certainly does not take a meteorologist to tell the difference between the two types of air. No matter where the tropical air went it could always be identified by the diagram—even though it rises over the top of a cold air mass to higher levels.

The curve marked Tp is from an air mass which originated in the South Pacific. It is called tropical Pacific air and is fairly common in the west, less so in the east. The Pacific polar (Pp) air is cold polar air which has had a long sojourn over the North Pacific. It is a very common type over the entire country. The dotted curve is an example of what happens when a warm air mass rides over a colder mass as at a warm front. The potential temperatures and moisture show that from the surface to 2 kilometers the air is modified (N) Polar Continental (Pc). From 2 kilometers up, however, the curve assume the general characteristics of Tp. This is a characteristic type curve indicative of overrunning warm air and when a weather-man sees it he knows that weather is brewing.

Every morning, then, more than 20 airplanes go up in all parts of the country and "sample" the air in their respective vicinity. The information is telegraphed to Washington and the weather-man has another important guide to future conditions.

Wave Disturbance vs. Low

It might be interesting at this point to show how differently the meteorologist of today views the typical storm compared with the synoptic meteorologist of pre-polar front days. Figure 7 shows the way a typical low would be represented by the weather-man a few years ago. It is the type known as "trough shaped" and its principal characteristic was the sharp change in the direction of winds as the trough or wind-shift line passed. This twpical low would bring a succession of clouds with rain and then a sharp shift of the wind to northwest with clearing weather.

Now compare this typical low with the wave disturbance in Figure 8. This is the way the modern day meteorologist represents the storm—segregated into three different sectors. The cold air north and northeast of the warm front is being overrun by the tropical mass of the warm sector with consequent clouds and rain. The warm sector itself is a region of occasional clouds and thundershowers —typical of warm, unstable air. To the west and northwest of the cold front is the region of cold northerly winds which are undercutting the tropical air of the

warm sector, bringing squalls and thunderstorms, but which will soon clear to the characteristically cool dry air of polar origin.

Another item of interest is the fact that the smooth rounded isobars are interrupted at the cold and warm fronts. The sharp bend is the result of refraction, much the same as the apparently sharp bend seen when a straight stick is thrust into water. The isobarics surfaces are bent as they pass from the denser medium of cold air into the lighter medium of warm air and vice versa.

The Air Mass Map

We are now at the stage when we can compare the map in Figure 1 with a map the modern meteorologist would draw. The latter is illustrated by Figure 9.

The two maps cover identical situations, yet with the air mass map the present day aeronautical meteorologist can estimate the heights of clouds or ceilings, the intensity and duration of precipitation, times of passage of the various fronts, with their attendant phenomena, the probability of fog, thunderstorms and icing and many other items that would be only guesswork with the other type map.

Besides this the air mass meteorologist has at his elbow diagrams of the vertical structure of the atmosphere across half a dozen sections of the United States, cloud and humidity maps and charts showing the direction and velocity of winds up to 20,000 feet at hundreds of stations.

Maps now are being prepared every six hours instead of 12. Radio balloons are being sent far into the stratosphere carrying meteorological apparatus. In all, we can safely say that the time rapidly nears when air mass analysis will give aviation almost perfect forecasts and thus eliminate one of the greatest impediments to scheduled flying.

END

South Seas Clipper

(*Continued from page* 20)

blueprint paper were required in the building of this plane. When completed, its construction will have required the driving of approximately a million aluminum alloy rivets.

Fuel tanks in the wings and hydrostabilizers (short "water" wings that will give the plane stability while taxying on the surface) will hold 4,200 gallons of gasoline—enough to drive a car two and a half times around the world. Cargo holds in the center section of the wings and in a bow compartment will carry as much as five tons of mail and air express, more than the entire useful load of the largest existing twin-engined transports.

The big Boeing Clipper will have a high speed of approximately 200 miles per hour and a cruising range of 4,000 miles with forty passengers aboard. It will be operated by a crew of eight. Roomy sleeping quarters will be provided for forty passengers, while the day travel arrangement will provide accommodations for as many as seventy-two. The commodious berths will measure 6 feet 3 inches long.

A spiral staircase will connect the flight "bridge" or control quarters on the upper deck with the main deck, which will contain a series of spacious passenger compartments, dining and lounge salon, a private "honeymoon suite" galley, and men's and women's dressing rooms with hot and cold water.

To insure complete travel comfort on long transoceanic voyages, more than three and a half tons of the plane's weight have been allotted to the luxurious interior furnishings that are yet to be installed.

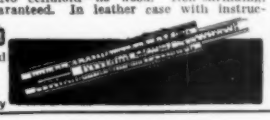
END

MANHEIM POCKET SLIDE RULE

Polished stainless steel back frame, flexible scale slide, glass hairline runner, A B C D scales. Length closed 6". No celluloid—no wood. Non-shrinking. Accuracy guaranteed. In leather case with instruction booklet.

Only $1.00

Postage Paid
Sevan Co.
Dept. 18
7 E. 42 St.
New York City

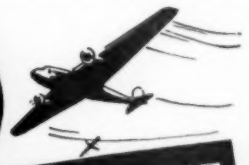


NOW ONLY $5.00

Over 6,000 GHQ Gas Engines have been sold at $8.50 for the Kit and $12.50 for the finished motor. Now is your chance to buy the **New Improved** kit for $5.00 or the assembled motor for $10.00. Send $1.00. Shipped Exp. Coll. for balance same day. Catalog 3c. **DEALERS WRITE.**

GHQ MOTORS, 854P East 149 St. New York

FOR SUCCESS IN AVIATION choose LINCOLN AN APPROVED SCHOOL



Many of tomorrow's well-paid Pilots and Mechanics are training at LINCOLN today! You, too, can be one of these fortunate men, and in a few short months be ready completely to qualify for one of the many jobs Aviation is offering Lincoln-trained men.

AVIATION CALLS YOU to a fascinating career with practically unlimited opportunities for advancement and good pay. Aviation offers you the chance to be a part of the world's fastest growing industry. You'll find at this Internationally recognized Lincoln School the complete, thorough training you need to successfully meet the demands of the aviation industry. You'll receive dependable, practical aeronautical knowledge and experience which will qualify you for a better job in aviation.

Your Training for Government Pilot's Rating

Your Approved Flight Training at Lincoln includes everything to make you a first-class pilot. A fleet of 14 modern training planes. Lincoln flight training offers you thousands of extra air miles. Plenty of cross-country experience, including an Airline observation flight to Los Angeles or New York.

$2,400 TO $6,000 A YEAR!

Airline Pilots earn up to $6000 a year—mechanics up to $2400. Train now at Lincoln. Get ready for one of these good pay jobs. We assist our graduates in locating positions.

Your Mechanics Training Prepares You for Aircraft and Engine Mechanics Position

12 shops and laboratories—wide variety of modern airplanes and airplane engines. Lincoln Training gives you every requirement for your Government Mechanics Rating. Training also in Aircraft Sheet Metal, Welding and Radio.

NOW IS THE TIME FOR YOU TO START TRAINING AT LINCOLN—APPROVED BY THE UNITED STATES BUREAU OF AIR COMMERCE FOR FLIGHT AND MECHANICS TRAINING.

Get Lincoln's book "Contact." It tells How Men are Trained for Aviation. Mail coupon Today for complete information.

LINCOLN AIRPLANE & FLYING SCHOOL

DIVISION OF LINCOLN AERONAUTICAL INSTITUTE, INC.

105 AIRCRAFT BLDG. LINCOLN, NEBRASKA

Lincoln Airplane & Flying School,
105 Aircraft Bldg., Lincoln, Nebraska.

I want to get into Aviation and would like to have your book, "Contact". Send me complete information about Lincoln Training.

NAME ..... AGE .....

ADDRESS .....

CITY ..... STATE .....

Old Boys

(Continued from page 62)

began taking flight instruction. Naturally, after they had soloed they began shopping around for planes to fit their particular needs. In almost every instance, they're buying cabin planes—closed jobs with all the comforts and conveniences of a sedan. And they want cute little luxuries, too—things like ashtrays, rear-view mirrors, heaters, ventilators, good upholstery and "nifty" instrument panels.

Unlike the old time transport pilot who used his ship for student training, passenger hops and occasional chartered flights, these middle-aged business executives want a lot of things besides economy and performance. For one thing they insist on "good looks." And, too, they demand ships whose lines and grace and color and upholstery and little knick-knacks will appeal "to the missus."

These Racine businessmen possess a holy horror of "monkey suits." They positively abhor and detest flying suits, helmets, goggles, or other raiment that might seem ostentatious or that might identify them as "intrepid airmen." That's another reason why most of them insist on cabin jobs.

They lived through the old auto days when cars had no windshields—and they do not repeat.

One thing more—just a little word of warning—unless you insist on suicide, don't walk up to men like Carlyle Godske, Jim King, Frank Rohan, or John Crawford and say "Happy Landings." They don't like the expression.

They think it smacks too much of fiction or the movies; too reminiscent of a smart-aleck era that seems to have become passe in aviation.

END

Flying Cops

(Continued from page 46)

and lamsters. It is mountainous enough to have been the scene of a score of major aerial accidents.

The need for efficient sky patrol is imperative. Sheriff Biscailuz's squadron is in constant service. Its members wear specially designed uniforms and are government licensed. They must be ready at any hour of the day or night for calls when they are not on regular duty.

They have served through floods, earthquakes, forest fires and dozens of emergencies of one kind or another. They have battled crooks with machine-guns in the air. They stage quarterly mass flights for practice. They have attracted so many pilots in California anxious to join that they have formed their own executive committee to pass on all applicants.

The present list of 50 active members reads like an aerial Who's Who of California. It includes army, navy and marine reserve pilots, sportsmen pilots, salesmen, film company executives and even actors, airplane company distributors, national guardsmen and professional stunt flyers. It is the most efficient volunteer patrol unit since the days of the hard-riding Vigilantes.

Claude F. Morgan, army reserve major, is captain of the squadron. He points out that personally the members of the organization have taken to his system of military control like birds to the air and credits it with the outstanding success of the squadron. Sheriff Biscailuz and Captain Morgan are both keen students of all phases of military flying.

Not so long ago, gangsters armed with machine-guns and using a fast monoplane were reported to be smuggling two Chinese into the country from Mexico. They swooped down on Vail Field, the Chinese leaped out, and the gangster plane was off again. A police plane took off in hot pursuit. The gunmen swung a Thompson into action and drew the fire of their pursuers. Then came a running dogfight. But the weather gave the gangsters the break by swallowing them up in clouds.

The fact of the matter is that so well has the Los Angeles unit been organized that gangsters have become exceedingly cautious about using the skies for their own purposes. The result is that these flying Vigilantes must content themselves with ceaseless practice flights, routine patrols and ground duties.

Potshots at crooks and roaring, zooming dogfights with gangster planes are succeeded by the other myriad of duties incident to the climate, geography and terrain of the area patrolled. The Los Angeles flying deputy holds himself in readiness to respond to calls ranging from dropping tear gas bombs on rioters to setting his ship down in an earthquake area to assist in rescue work.

It is only a matter of time, however, before the nation's aerial police will have the problem of piracy on their hands. Modern day crime got its start with the introduction and perfection of speedy transportation and rapid communication. It will always be nip and tuck between cop and crook. The crook thought he had something when he used pigeons. Flying cops broke that up in a hurry. The flying gangster met the flying cop with machine guns. He is now stalemated and can find few pilots willing even at a price to run the risks involved.

But the airmail is likely the next target just as the railway mail attracted the James boys and the Youngers many years ago. The liquor racket is virtually ended so far as aerial operations are concerned, but smuggling aliens and narcotics are still profitable in a big way. There remains Uncle Sam's airmail and crooks being the world's ace suckers, somebody, sometime in the future, is bound to take a crack at it and be dodging G-men the rest of his unnatural life.

Slowly and surely, but all too slowly, flying cops are gaining a foothold. Here's a pilot's-eye view of the situation as it is today:

Dayton, Ohio, quite by accident the home of the airplane, has at least been alert where the use of aerial police is concerned even if the local department has no regularly constituted unit. Probation Officer C. M. Worley got things off to a flying start when he took a prisoner to the reformatory by air.

Three members of the Dayton department, Ray Herolzer, C. F. Shaner and E. L. Plummer, are pilots. Shaner flew Worley and Detective Everett Busch to the reformatory with their prisoner, and since then the idea has spread. One prisoner, however, sentenced to die in

AIR FACTS

FACTS • KNOWLEDGE • SAFETY

Airplanes just do not fall out of the sky without reason.

In the study of TWO HUNDRED serious accidents per annum (other than Airline or Military) there are many things to be learned about safe methods of flying.

AIR FACTS gives you in its monthly Reports a detailed analysis of such accidents, and affords you an opportunity to see in what respects neither the limitations of the MAN nor the MACHINE must be exceeded.

AIR FACTS Reports are issued once each month, cost $3 per year. You will find they bring you information you have wanted from the start of your flying career. Act now!

Air Facts, Inc.,
1775 Broadway,
New York, N. Y.

Date _____

Gentlemen:

I want to fly safely in 1938. Please send the next twelve AIR FACTS monthly reports to aid me in doing so.

Name .....

*Annual Service Charge of $3 is enclosed.

Street .....

City ..... State .....

the electric chair, refused to be flown to the penitentiary's death house. "It's too dangerous," he said.

A certain form of police work has been performed by Army pilots at Wright Field who were assigned to guard the civilian payroll trucks. They followed the trucks in and out of Dayton, training machine guns on the road. While the trucks were at the bank, the pilots flew up and down the principal street watching for robbery attempts.

The Mexican border, always the scene of war between cops and crooks, is not now guarded by an aerial unit. That is only a temporary situation, however, your reporter understands. Do you remember the time, almost yesterday it seems, when U. S. Border Patrolmen Hensler, Tulley, Wall and LeVine spotted a heavily laden cabin job coming up from Mexico? The boys took off in pursuit and chased the smugglers all the way up to Los Angeles. The cargo of aliens captured was being shipped at $1,000 a head.

The rest of the country is not very well organized although the reports from individual police departments all show that they have many members who are reserve pilots of the army or navy and that they are hoping to get under way very soon with organization work.

Denver, progressive in such matters, has not yet been able to afford a regular aerial unit, but Chief George Marland thinks the nature of the country will soon demand it. Commissioner James P. Allman, of the Chicago police, notifies your reporter that the department at present has no regularly assigned flying unit.

However, the department has many qualified pilots and the problems of land and lake traffic control are piling up. Cleveland, intending to have its own unit, recently completed a series of experiments in traffic control by air. Deputy Traffic Commissioner Martin A. Blecke prefers blimps for this work and would like to see autogiros used for criminal apprehension.

Philadelphia, likewise, is in a transition era. Police there have been pleased with the results of tests made with the autogiro. They report that, on an average, a machine-gunner in this type craft can score better than 50 percent hits against a fast-moving gang car.

Detroit's most sensational use of the airplane in police work was the capture of the murderer of Gerald Buckley, radio announcer, who was shot down in a hotel lobby. Fast work by detectives spotted the suspect in New York. An officer flew there and nabbed him in the act of skipping the country for Italy.

At present, the greatest need for aerial police is not to chase bandits and take part in criminal investigations, but to master the ever-increasing intricacies of traffic control, protection of life and property, and chase reckless pilots out of the airlanes.

If the police can prevent it, no more blimps will plummet through bank roofs killing and injuring scores, and crowds won't be terrorized by foolhardy pilots.

END

FOR ITS FIRST BIRTHDAY

Popular Photography presents

ITS BIGGEST ISSUE

124 PAGES CHUCK-FULL OF EXTRA ANNIVERSARY FEATURES

Special COLOR INSERT

- —displaying in full color the masterly work of Ivan Dmitri. The color photographs in this insert, published for the first time, will illustrate the article on how amateurs can take inexpensive snapshots in color.
- CAMERA DIRECTORY—the most comprehensive camera guide in existence. Presenting for the first time an alphabetical listing of the most popular cameras and their accessories. In authority, in completeness, in sheer physical size it surpasses any similar camera directory ever published. It's brand new . . . up-to-date . . . completely illustrated.
- FILM CHART—giving all data and important characteristics on all commonly used films today—speed ratings—filter factors—and an authoritative general discussion.

PLUS A SCORE OF OTHER FASCINATING FEATURES AMONG THEM:

- The A B C's of Making Movies at Home
- A Study of Lens, Diaphragms and Shutters
- Camera Regulations in Foreign Countries
- 30 Outstanding Pictures in the Salon Section

YOU CAN'T AFFORD TO MISS THE SPECTACULAR MAY ISSUE

NOW ON SALE AT ALL CAMERA STORES AND NEWSSTANDS!

AVOID A SELL-OUT USE THIS COUPON!

POPULAR PHOTOGRAPHY
608 S. Dearborn St.
Chicago, Ill.

I don't want to miss this Anniversary issue. Enclosed find $1 for special introductory subscription of 6 issues of POPULAR PHOTOGRAPHY.

Please start my subscription with.....issue.

Name _____

Address _____

City _____ State _____

☐ I prefer a one year subscription at $2.50. ☐ Two years at $4.00.
(Foreign postage $1 extra per year.)

WORLD'S GREATEST *all around* ELECTRIC TOOL

DRILLS—GRINDS—SANDS—SAWS
POLISHES—SHARPENS—CARVES

The new WHIZ ELECTRIC TOOL is the handiest, most useful power tool ever made. Not a delicate instrument but a real rugged tool, equally effective for both power and precision work. Drills through ¼-inch iron plate in 42 seconds or engraves intricate designs on jewelry. Handles any material: Metals—Woods—Alloys—Plastics—Glass—Steel—etc. Saves time. Eliminates tedious labor. Plug into any socket AC or DC, 110 volts. Chuck ¼" capacity. Ball bearing thrust. Powerful, triple-geared motor. "Worth its weight in gold," to a mechanic or handy man. STANDARD MODEL, with normal speed (uses 50 different accessories, instantly interchangeable), only $6.95.

FREE Accessory outfit (Value $2) includes set of drills, mounted 1½" grinder, sanding discs, cutting wheels, mounted brush, polishing wheel, etc. FREE with each outfit ordered NOW. We pay postage on all shipments. Will send C.O.D. if desired.

Special "2-SPEED" MODEL combines Normal Speed and High Speed in one outfit (uses 200 accessories) only $8.95 complete, with above accessories and carving bur FREE.

Paramount Prod. Co., Dept. S-PA, 48 W. 48th St., N. Y. C.

AIRPLANE PHOTOS

8 x 10
50c
3 for $1.00
New Ships!

Beautiful, clear, sharp photos, ready for framing, of modern ships. ¾ front, side and flight views.

SEND 10c FOR FIVE 2¾x1¾ PHOTOS AND COMPLETE LIST

Then make your selection of those you want in 8x10 size. Send dime to Dept. X.

METROPOLITAN STUDIOS
6001 S. Cicero Ave. Chicago, Ill.

IMPERIAL LEADS
IN QUANTITY, QUALITY, AND VALUE
24 HOUR SERVICE FREE POSTAGE On All Orders East of Miss. for 75c or Over

SEND 2c POSTAGE FOR CATALOG

18" BALSA
1/16x1/16 100, 5c
1/16x⅛ 35 for 5c
1/16x3/16 18, 5c
1/16x¼ 15 for 5c
1/16x½ 5 for 5c
3/32x3/32 30, 5c
⅛x⅛ 30 for 5c
⅛x3/16 12 for 5c
⅛x¼ 10 for 5c
3/16x3/16 8, 5c
¼x¼ 6 for 5c
¼x½ 3 for 5c
⅛x½ 2 for 5c
1/64x2 4 for 10c
1/32x2 8 for 10c
1/16x2 8 for 10c
3/32x2 7 for 10c
⅛x2 6 for 10c
3/16x2 3 for 9c
¼x2 3 for 10c
3" sheets or 36" lengths, double above prices; add 10c packing charge for 36" lengths.

18" PLANKS
1x1 5c; 1x2 6c
1x1½ 8c; 1x2 10c
1x3 15c; 2x2 18c
2x3 23c; 2x6 39c
3x3 40c; 3x6 75c

NOSE BLOCKS
1x2x1..... 1c
2x2x1..... 2c
2x2½x1..... 3c
3x3x1..... 5c
3x3x2..... 8c
3x3x3.....10c

TISSUE, AA
All col., doz. 19c
Silver ....ea. 5c
Superfine, wh. 5c

WHEELS per pr.

	Birch	Balsa	Celu
½	.01	.03	
⅝	.02	.04	.05
1	.03	.05	.07
1⅜	.04	.08	.10
1¾	.07	.10	.16
3	.15	.15	.30

WASHERS
1 doz. ⅛ or ¼ 1c
THRUST BEARINGS
Small ...doz. 10c
Large ...doz. 15c

Your choice of one of these FREE OFFERS with all orders for $1.00 or over

FREE
A. Large bottle clear cement and 60 1/16 x1/16x18 balsa
B. 2 pr. 1⅞" Birch Wheels
C. 3 sheets silver tissue
D. Membership Pin in IMPERIAL MODEL CLUB which entitles you to 3% discount on orders of $2.50 or more

Send 3c for Gas Model Catalog

CLEAR DOPE OR THINNER
5c per oz.; large bottle 8c; ½ pt. 30c; 1 pt. 45c
COLORED DOPE
6c per oz.; large bottle 10c
CLEARCEMENT
5c per oz.; large bottle 8c; ½ pt. 35c; 1 pt. 55c

PROPELLERS

Balsa	Paul-O-Mach. Cut	Wins
5"	4c	10c
6"	5c	15c
7"	6c	20c
8"	7c	25c
9"	8c	30c
10"	8c	35c
12"	10c	45c
14"	14c	55c
15"	15c	60c

RUBBER
.045 ....25 ft. 5c
1/16 sq., 15 ft. 5c
⅛ flat...15 ft. 5c
Skein 50c
3/16 sq., 10 ft. 5c
RUBBER LUBRICANT
Large bottle 10c
SANDPAPER
Doz. sheets...5c
WIRE, 2 ft., 1c
6-8-12-14
CELLULOID
6 x 8..... 5c
12½x16.....18c

PROP. BLOCKS
½x ⅝x 5 6—5c
½x ⅝x 6 6—5c
⅝x1 x 7 4—5c
⅝x1 x 8 3—5c
⅝x1¼x10 3c ea.
⅝x1¼x12 3c ea.
1 x1½x12 4c ea.
1 x1½x15 7c ea.
BUSHINGS
1/16....4 for 1c
BAMBOO
1/16 sq.x12, 36, 5c
1/16x¼x15 dz. 10c
SHEET ALUM.
.0004x5x11½
2 sheets 3c
.005 in. 6x6 5c
.010 in. 6x6 6c
.015 6 x 6 8c
1/32 6 x 6 15c
ALUM. TUBING
1/16,3/32, ⅛ ft. 7c
3/16 or ¼ ft. 10c
INSIGNIA
24 and stripes 5c

FREE POSTAGE on all orders in U.S. east of Miss. for $1.00 or over. West of Miss., add 10c. Under 75c, add 10c. Canada, U.S. Possessions, and foreign, over $1.00 add 15c. Foreign, under $1.00, add 15c. No C.O.D. No stamps.

DEALERS: Send for Wholesale Price List

20 IN. FLYING PLANS 10c—3 for 25c
Sparrow Hawk, Boeing Trans. 247, Spad Chass., Vought Corsair, Curtiss Swift, L. W. Waco Cabin Biplane, Douglas Dolphin, Boeing P12F, Fokker D-VII, S.E.5, Goshawk, Gee Bee, Boeing P26A, Monocoupe, Northrop Gamma, Fairchild 24 Cabin, Corben Super-Ace.

SELECT ANY 1 OF THE ABOVE PLANS 35c
in 20" FLYING KIT Postpaid

IMPERIAL MODEL AERO SUPPLY
416A McDONALD AVENUE BROOKLYN, N. Y.

Letter from Noonan

(*Continued from page 52*)

sively since first published in the Air Almanac. The second-setting watch runs it a close second as a time saver and an aid tending to minimize errors. Navigators owe you a debt of gratitude for those contributions to the science.

"I suppose you wonder which method I use for computation of observations. I use Dreisonstok exclusively. Probably another prejudice, but I have used it since it first became available in 1927 or 1928, and still prefer it.

"I would appreciate further communication with you upon any navigation matters which might be of mutual interest.

"Thanking you very much for your letter, which really was greatly appreciated despite my tardiness in replying, I am

Very truly yours,
FREDERICK J. NOONAN."

The writer feels that Noonan's letter scarcely needs comment, since it gives about as clear a picture of the details accomplished aboard an ocean-going plane as could be given in a short article. The fact that Fred Noonan was Musick's navigator at one time and the fact that Musick was lost recently in the *Samoan Clipper* will help to clarify in the minds of the public the question of the navigation of the planes. Without doubt, the loss of the *Samoan Clipper* had nothing to do with navigation. It is further the writer's opinion that some complication other than problems connected with navigation caused the loss of the Earhart plane.

A scheduled plane such as the *Samoan Clipper* has a tremendous advantage over a plane such as the Earhart plane in that the clipper planes fly over scheduled routes after careful preparation with ample personnel and equipment and supported by trained shore stations to give constant communication by radio, radio bearings, and meteorological and other data. Obviously, after the crew of a clipper plane become familiar with the route over which they are flying, the problems of navigation are greatly simplified. By experience, the vagaries of wind and weather are better understood, and by practice, positions by radio and celestial navigation are more correct.

While more and serious accidents may be expected in the future in connection with flying, the advance in navigation along with a parallel advance in plane construction and engines will gradually reduce the losses in these departments.

The factor most likely to cause future losses is that connected with nature itself. We all know that when Mother Nature takes charge as in the case of lightning and storms, man-made machines fare very badly. This is true whether the machine is an ocean liner, a battleship, or a plane. In the worst storms, even ocean-going ships suffer thousands of dollars worth of damage. Apart from the problems connected with marine navigation, we must face the hazards of fire, icebergs, collisions and hurricanes.

END

Bird Flight

(*Continued from page 50*)

supplied animal for aerial locomotion. The development of feathers was a very slow process. Its light structure, lighter than any man-made form for the same loading, shows minute details; composed of a main stem or shaft, extending into a supplementary shaft or after stem; located on each side a web or vane; each vane has a set of barbs, each barb a series of barbules; most barbules have a set of barbicels and a series of hooklets.

The location of the shaft, is about 25 per cent from the leading edge of the feather; this location is at the same point where the well known aerodynamic center on standard airfoils is located. The aerodynamic center is the point where all moments are the same. Thus the feather will deflect without torsional variation. The cross section of the shaft is similar to a metal box spar. In case the feather should twist for stability or propelling purposes the shaft is at about 17 to 20 per cent of the chord. Feathers, having the air flowing parallel with the shaft, have the stem located centrally.

Sec. 7, Sec. 8 and Sec. 9 show some detail of wing and feathers. The main feathers, the contour feathers (exposed to light) comprise the primaries, the secondaries and the tertials. They are overlapped by coverts and subcoverts, filled with downs to give the wing a cross section similar to a low speed airfoil. This interwining, expandable, airtight and smooth structure shows the finest triangulated structure that will shape itself to a wing section giving lifting forces under any air flow condition, may it be rising, pulsating or oscillating.

The steadier the air flow, the longer are the feathers. The upper surface has less and longer feathers than the lower surface of the wing. The armpit has only a few long feathers. The lower surface has many rows of small coverts to allow the change in camber, especially to form a sharp curvature, known as Phillip's entry, when stalling.

The emarginated primaries on broad wings or the wing tips on high aspect ratio wings are automatic ailerons, a stability device actuated solely by the changing wind direction. Sec. 9 indicates this action. The primaries are bent upward at high angle of attack and bent downward at low angle of attack, in order to attain the same lifting power. This valvular action may be observed easily, sometimes two to three times a second, gives the false impression of a flutter propulsion.

Birds with narrow wings drop the whole wing at low angle of attack, and, if the weather condition becomes so bad that the moved wing reaches 90 degrees, they will seek higher altitudes or stop flying.

Birds soaring close to shore may have one side up and the other down which indicates two wind directions.

Another proof for this stability action is the soaring and gliding of pelicans;

(*Concluded on page 90*)

NEW CURTISS F11C4 NAVY PURSUIT

28" Span. Length 20½". Weight 4 oz. 1" Scale

THE MOST EXCLUSIVE AND FINEST EQUIPPED MODEL IN THE WORLD
A special De Luxe model, one of the most beautiful and finely detailed ever made, with its special exact scale 3¾" celluloid, 1000 H.P. type, Wright Cyclone motor, having aluminum push rods, cylinder fins, etc., like real motor. Also in set are 4" aluminum cowl ring, 9" carved spruce semi-scale flying propeller, colored star and rudder insignia, 2" celluloid balloon wheels, silver dope, paint, black, red stripping, Navy lettering, wire parts formed, axles, rubber motor, windshield, instrument board, flying wires, 4 aluminum step plates, aluminum wing walks, ready cut wheel pants, etc. All other parts printed on balsa. Detail scale drawing.
Construction Set complete, postpaid **$4.50**
Built model ready to fly, as shown ..... $22.00 F.O.B., N. Y.

41" LOCKHEED ARMY SPEED VEGA

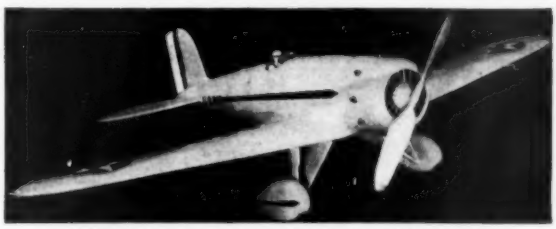
NEW LOWER PRICE ON DRY SET.

41" Span. Length 28". Weight 8 oz. 1" Scale

This new model, built very strong yet light in weight, is practically crash proof and will out-perform any large scale model built. Rises from ground in 10 feet and flies over 650 feet. Set contains all parts printed on balsa, ready cut pant cores, 4¼" turned motor front, 11" steel type carved paulownia wood propeller, 2½" balsa wheels, tail wheel, formed wire parts, 26" rubber, full size scale drawing, and all parts. This is a dry set without paints or liquids.
Complete set, postpaid **$3.95**
If paints, liquids, and glue are desired, add 55c. Built model, ready to fly, as shown, $25.00 F.O.B., N. Y.

Note: In issuing money orders, use St. George, N. Y., postoffice

NEW LOCKHEED P23A NAVY FIGHTER



COMBINATION LAND AND SEA PLANE SET
32" Span. Length 20½". Weight 3½ oz. ¾" Scale
Complete Set with Colored Paints, etc. Postpaid **$2.95**

NEW BOEING F4B4 NAVY FIGHTER

22½" Span. Length 14½". Weight 2½ oz. Color, Grey, etc.
Const. set with colored paints, celluloid motor, aluminum cowl, 8" carved prop. Complete set, postpaid **$2.95**

Northrop A-17 Army Attack Fighter

24" Span. Color, Blue and Yellow.
Const. set with colored paints, etc., postpaid **$2.50**

LOCKHEED VEGA GAS MODEL

Model uses Brown or other 1/5 H.P. motors
82" Span. Weight with motor 5 lbs.
Set contains formers, ribs, tips, pants, etc., all ready cut to shape, 8¾" turned motor front, 4½" rubber tired air wheels, silk covering, glue, and full sized drawing. This is a dry set without liquids.
Price set, f.o.b. N.Y. **$17.50**

LOCKHEED ELECTRA R-20-1

27½" Span. Length 17". ½" Scale
Set has all parts printed on balsa, turned motor fronts, carved steel type props, set of 3 colored paints, glue, etc., balsa wheels, concealed motor unit through fuselage. Scale drawing.
Construction Set complete, postpaid **$2.95**

BOEING P26A ARMY FIGHTER

22" Span Length 17" ¾" Scale
Set has 3" celluloid motor, tapered alum. cowl, 8" prop shown, all parts printed on balsa. Set of colored paints. This is finest P26A model on market.
Construction Set Postpaid **$2.75**

New Curtiss Army Hawk "75" or P36A

37" Span. Length 27". Color, silver
Complete set with paints, postpaid **$3.25**
Set with 4" celluloid motor and cowl, postpaid **$4.00**

New Lookheed P24B Army Fighter

32" Span. Length 21". Color, Blue, Yellow
Set has all parts printed on balsa. 9" carved prop shown. Set colored paints. A beauty for looks and flights. **Set Postpaid** **$2.95**

New Stearman PT13 Army Trainer

18" Span. Length 12". Weight 1½ oz.
Set has all parts printed on balsa, 2" celluloid motor, 6" carved prop, colored paints, and all parts as shown. Set with colored paints, etc., postpaid **$1.50**

3¾" celluloid motor, alum. push rods, used on our Curtiss F11C4.
Price **$0.75**

SEND 10c COIN for 1938—16-page illustrated catalog, showing latest army and navy models

California Dealer: Reginald Denny Industries, 5751 Hollywood Boulevard, Hollywood, Calif.

MINIATURE AIRCRAFT CORP., 83 Low Terrace, New Brighton, New York

A CANDID CAMERA
For 10 days ON APPROVAL!

SPEED.. ACTION .. EXCITEMENT!
Catch it all with this mighty little Candid Camera! You won't believe it possible at this low price, so we want you to try it out at our risk! Take all the pictures you want, under any conditions. Test out the remarkable clarity of the lens . . . the accuracy of the view finder. Compare it in action with any of the cameras selling for $10 or $20. Then if you do not think this is the most remarkable camera bargain you ever saw, it won't cost you a penny! Fully Corrected Wollensak 50 M.M. lens. Speed shutter. Fixed focus makes it possible to get sharp pictures at all times. Telescopic Finder. Tripod Socket. Uses economical 127 V.P. or Agfa A.8 film in color or black and white. 16 pictures on a roll. Has compartment for extra roll of film. Enlarge clearly up to 8" by 10". ORDER NOW for Special Introductory Price of only $3.98 Postpaid. C.O.D. if preferred plus postage.

$3.98 ONLY

CANDID CAMERA SUPPLY CO.
303 West 42nd Street Dept. 22 New York, N. Y.

COLT 45 Cal. "FRONTIER" MODEL $1.45

Basswood construction kit with working plans, machined barrel, cylinder and all necessary hardware.

COLT 45 Cal. "FRONTIER" model kit, 4¾" barrel.$1.45
COLT 45 Cal. "FRONTIER" model kit, 5½" barrel. 1.55
COLT 45 Cal. "FRONTIER" model kit, 7" barrel. 1.70
COLT 45 Cal. Automatic Pistol kit..... 1.00
Half scale Thompson Sub Machine Gun model kit... 1.00
Full scale Thompson Sub Machine Gun model kit... 3.00
SAVAGE Cal. 32 Auto. Pistol kit, machined barrel.. .75
LUGER Auto. Pistol with 4" machined barrel..... 1.75
LUGER Auto. Pistol with 6" machined barrel..... 1.90
COLT 25 Cal. Automatic Pistol kit..... .50

These beautiful kits are complete in every detail and made of the best basswood. All parts are cut to shape and require only a short time to finish. Postpaid in U. S. A.

GUN MODEL CO.
Dept. K-45, 2908 N. Nordica Ave., Chicago, Ill.

The "TRU-DETAIL" FLYING SCALE MODEL of the GRUMMAN S.F.1

Wing Span 21 3/8" Retractable Landing Gear

The only Kits using Paulownia and Balsa wood for construction. Each kit contains 230 completely finished parts of Balsa, Paulownia and Metal. The 70 ribs for upper and lower wings are finished, formed and notched. 2 propellers, one for flying and the other scale for exhibition, cowling, nose piece plug, scale wheels, motor parts, bulkheads, tail plug, skid wheels are all finished and formed ready for assembly. Struts are cut to size and streamlined; elevator and rudder surfaces are formed. 5 pieces of colored tissue, rubber, rubber lubricant, brush, insignia, cement and dope, also 2 plans and separate complete instruction and coloring chart, combined to insure a perfect construction job. Price complete— Postpaid $2.50

Other Flying Kits with Fully Finished Parts

Goeppingen 1 .....$1.50 The Flying Flea.....$2.00
Fokker FX 1.....2.00 Kawasaki C 5.....2.50
Vought Bomber.....$3.00

Goeppingen 1—Soarer...40" Flying Flea.....23¾"
Fokker FX 1.....25¾" (Pou-De-Ciel)
Vought Bomber.....27⅛" Kawasaki C-5.....29⅛"

Send 10c for our complete catalogue with propeller, motor efficiency chart and guide.

INTERNATIONAL MODELS COMPANY
251 West 55th Street New York, N. Y.
Distributors in all Foreign Countries

Bird Flight

(*Continued from page 88*)

the soaring pelican has its wing tip bent upward; gliding close to the water surface the tips are bent down, very often touching the water surface. (Sec. 14.)

This automatic equalization of lift will be a simple explanation of utilizing the internal energy of the oscillating and the pulsating air current. By closer investigation they could be reduced to the problem of the rising air current.

To have an efficient entry of the air current the leading edge of the wing is usually 90 degrees with the side of the body. The general design of a bird is a near mid wing, a location proven by laboratory tests to be the best location for a low powered airplane; the armpit with its small filets gives the compressed air an undisturbed flow to the tail.

The tail of a bird is of peculiar design. At high speed and when soaring the tail is folded to give the lowest resistance possible. The design of the tail is co-ordinating with the design of the wing. When stalling the tail is opened and the wings moved forward in order to restore the balance, for the tail added new lifting forces aft of the original center of pressure. To give the tail an effective air flow there is usually a slight cutout where the trailing edge connects to the body. A slight twist of the tail when making climbing turns is the only visible means of control; a rudder action is created by upward bent tail tips.

The head of the bird plays a big role in controlling the air flow. Small feathers indicate exactly the direction of the air flow. The head is usually larger than the neck in order to prevent changes of the direction of the air flow when turning it to look for food. In case there is a slight gap between the head and the body when soaring crest feathers are provided for streamlining; they are very pronounced on pelicans and herons. Birds with heads devoid of feathers have airsacs at the neck which they blow up to reduce air resistance.

The airsacs have another application in bird structure; the bird when resting on ground or water folds its wings into a cavitation of the body; this cavitation is blown up with an airsac immediately after the bird spreads its wing in order to streamline the body. Years ago these airsacs were supposed to enable the bird to soar.

The beak of birds has a design not conforming to aeronautical standards, but its purpose is indicated by the diamond cross section, dividing the air flow into four main air flows. Thus by greater displacement of the head the flow can be directed to the part of the bird where it is required.

The nostril and its location depends on the habitat of the bird. Birds soaring over land have them usually on the side and often protected by small feathers. A certain turbulency created by the beak will supply clean air to the lungs. Sea birds, especially the albatross, do not need this precaution and have their nostrils directly in the airstream. This design, which has no resistance, should be of interest to the engineer designing air intakes for carburetors and radiators. (Sec. 16.)

The same careful detail is present for the protection of the eyes against direct air stream; usually a slight ridge around the eyes creates a fixed turbulency. This kind of turbulency is very pronounced with the great white owl, which has its eyes set so that it is protected against any noctural encounter. The placement of the feathers shows the radial air flow and explains the big fixed turbulent cone in front of the head to streamline the body as shown in Sec. 15.

There is a small wing at the first joint called the alula or the thumb which acts as an automatic control tab for the wing.

It may not be out of line if the problem of the required power of bird and that of the airplane is compared. A formula which may be applied to bird and airplane, noted in Sec. 13, is based on the wing loading and power loading. The power produced by the bird is assumed to be in direct proportion to the weight of the pectoral (chest) muscle, and to be able to give .072 h.p. for each pound of muscle. The result shows that the bird has a greater lifting ability than the airplane.

In conclusion it may be mentioned that the copy of a bird was only detrimental to the advancement of aviation. The only benefit derived from the study of bird flight was the cambered wing section; nevertheless, a more scientific study of soaring birds may show us new ways of improving stability on airplanes, for today all problems on soaring can only be proved from laboratory tests on hand.

END

AMAZING NEW ENGINE!

Wonderful NEW HORNET Gas Model Motor Weighs only 3¾ ounces—YET has ONE-EIGHTH Horse Power!

The last word in engine efficiency and performance for models having a wingspread from 36 to 50 inches

- **WEIGHT OF ENGINE ONLY 3¾ OUNCES**
- **⅛ H. P. •R. P. M. 300-10,000**
- **NO TENDENCY TO OVERHEAT**
- **DESIGNED TO OPERATE IN UPRIGHT OR INVERTED POSITION**
- **FOR MODELS HAVING WINGSPREAD FROM 36 TO 50 INCHES**
- **ENGINE ONE-PIECE MONA-DURALUMIN TO ASSURE RIGIDNESS PLUS EXCELLENT COOLING QUALITIES**

$17.50 *postpaid*

ENGINE COMPLETE—Postpaid in U. S. $17.50

Send Orders Direct To:

AVIATION PRODUCTS CO.
619 South Federal Street
CHICAGO ILLINOIS

Two Lucky Marines

(*Continued from page 12*)

his nerves quaking. Morale quickly returned to this typically military flyer, however, and he took charge of his "phantom plane," sped away from Kearney Mesa and landed safely, a few minutes later, at North Island.

Then Lieutenant Morrow learned what had probably saved his life. During the careening descent of his plane, a major portion of the target sleeve had worked itself loose and fallen from the wing. Thus, when he made his last desperate lunge into the cockpit with the odds seemingly so great against him, he was once again able to manipulate the controls.

And this is just one of the many combinations that are possible with the mechanisms of airplanes in flight.

They still talk of 2-MS-3 as the "phantom plane" and its two occupants, Lieutenant Morrow and Corporal Frankel, as the flyers who outgrinned death to live through a situation that ordinarily happens only in the wildest fiction.

END

Sky Lights

(*Continued from page 21*)

they have been carried as far as possible in this manner they are then hauled up to the tower and onto the platform by means of ropes.

In the matter of assembling a four foot beacon on a six foot square tower the worker discovers that he is quite like the man on the flying trapeze and if any kind of a fresh breeze is blowing he has an aerial artist's job in keeping the beacon from rolling back down to the foot of the mountain.

When the tower and its attendant automatic machinery has been erected, its care is turned over to an airways mechanician who has problems of his own in servicing and keeping in operation several beacons over a wide territory. Although it may be from ten to 15 miles between beacons the mechanic may have to travel 100 miles to service the machinery and if his towers cover an airline distance of 100 miles he can be pretty sure of covering nearly 2,000 miles a month by truck to haul gasoline and oil and repairs to his charges.

END

AERONAUTICAL UNIVERSITY

(Founded by Curtiss-Wright)

Government Approved . . . Accredited

Our graduates are with all leading aviation companies and air lines.

Courses in

AERONAUTICAL ENGINEERING

Mathematics, Drafting, Airplane Design, Stress Analysis, Wind Tunnel, etc.; thirty subjects.

LICENSED MECHANICS

Prepares for Government licenses: Airplane, Engine and Radio. Includes Sheet Metal, Welding, Drafting, Aircraft Construction, Engines, Inspection and Maintenance.

ADMINISTRATION

Transport, Traffic, Sales, Aviation-Advertising, Aerial Photography, Airport Accounting, Navigation, Meteorology, Airplanes, Engines, Radio for U. S. Government License.

Outstanding faculty. Up-to-date equipment. Reasonable tuition. Easy terms. Day and Evening Sessions. Enroll now.

ENROLL NOW

AU ACCREDITED

Address

AERONAUTICAL UNIVERSITY

CURTISS-WRIGHT BLDG.

Dept. P. A.

1338 S. Michigan Blvd.

Chicago, Illinois

REMEMBER YOUR CUB DEALER — HE IS READY TO HELP YOU

WHERE TO BUY SALES — **YOUR CUB** SERVICE

THERE IS A DEALER NEAR WHO CAN SUPPLY YOUR EVERY NEED
BE IT A COTTER-PIN OR A SQUADRON OF AIRPLANES

CANADA — CUB AIRCRAFT, LTD.

Complete CUB Service
Sales—Instruction—Parts
THE CANADIAN CUB
now approved on
Wheels—Floats—Skis
Information cheerfully given
Write or wire
CUB Aircraft Corp. Limited
Hamilton Ontario

MAINE — AIRWAYS, INC.

SALES-SERVICE AIRWAYS INC. SCHOOL-CHARTER

Northern New England Cub Distributor Government approved Repair Sta. #245.
AIRWAYS, INC. Waterville, Maine

PENNSYLVANIA — McCRAY FLYING SERVICE

NEIL B. McCRAY
CUB & STINSON DISTRIBUTOR
FOR WESTERN PENNA.
& CHAUTAUQUA CO., N. Y.
CALL, WRITE OR WIRE FOR DEMONSTRATION
ERIE CO. AIRPORT, FAIRVIEW, PA.

ILLINOIS — TUFTS-EDGCUMBE, INC.

TUFTS-EDGCUMBE, INC.
Northern Illinois Distributor
PAL-WAUKEE AIRPORT,
MT. PROSPECT
New & Used CUBS for Sale
TRADES—TERMS
Write us or call WHEELING 69
to arrange for a demonstration

NEW JERSEY — BENNETT AIR SERVICE

NEW JERSEY, NEW YORK CITY, LONG ISLAND, PHILADELPHIA Bennett Air Service
HIGHTSTOWN, N. J.

END your own depression with a Cub. We show you how to make money with a Cub. We shall be glad to explain our proposition if you will come to Central Jersey Airport or wire for our representative to see you.

Bennett Air Service, P. O. Box 47, Hightstown, N. J.

TEXAS — LOU FOOTE FLYING SERVICE

DON'T PAY TO LEARN!
WE GIVE A FREE SOLO COURSE WITH EACH NEW CUB PURCHASE.
GET IN ON OUR EASY-TO-BUY NOW! DON'T WAIT UNTIL THE RUSH STARTS.
THIS IS THE CUB YEAR
SALES SERVICE STORAGE
LOU FOOTE FLYING SERVICE
HANGAR A LOVE FIELD DALLAS

MARYLAND — JOHN HINSON

JOHN HINSON, DISTRIBUTOR for MARYLAND, DISTRICT OF COLUMBIA and NORTHERN VIRGINIA. OFFICE AT 740 FOREST DRIVE, HYATTSVILLE, MARYLAND.
AIRPORT—QUEENS CHAPEL, HYATTSVILLE, MARYLAND.
CALL OR WRITE TO-DAY FOR DEMONSTRATION IN THE NEW CUB SPORT. THE LATEST WORD IN LIGHT AIRPLANE BEAUTY AND PERFORMANCE OF TO-DAY.

NEW YORK — HYLAN FLYING SERVICE

HYLAN FLYING SERVICE
Distributors for
CUB
Airplanes
In Central & Western New York
NEW — USED
Rochester Airport
Rochester, New York
Telephone—Genesee 7657

VIRGINIA — WILLIAM T. McGALLIARD

BUY A CUB AND LEARN TO FLY
WITH YOUR NEAREST DEALER
Charles Kilgore—721 Pearl St.—Bristol
Southern Airways—Municipal Airport—Danville
W. W. Edmondson—Preston Glenn Airport—Lynchburg
Jeff Nolan—Central Airport—Richmond
Frank C. Reynolds—Municipal Airport—Roanoke
H. H. Faber—Valley Airport—Waynesboro
FOR DEMONSTRATION OR INFORMATION
WRITE WM. T. McGALLIARD, DISTRIBUTOR
Gordonsville, Va.

OREGON — ART WHITAKER

ART WHITAKER
Portland Airport—Portland, Oregon
Distributor for Oregon, Washington, Idaho
Complete parts—repairs—service

NORTH CAROLINA — CAMEL CITY FLYING SERVICE

SEE McGINNIS!
Carolina's Air Sales Headquarters.
WINSTON SALEM, N. C.
Authorized Parts and Service for Continental Motors up to 150 H.P. Competent Instruction. Reliable Charter Service.
CUB—STINSON—CONTINENTAL

WEST VIRGINIA — CLARKSBURG FLYING SERVICE

The following dealers will also be glad to demonstrate a new CUB and explain our "EASY TO BUY AND EASY TO FLY" plan.
Parkersburg Flying Service, Parkersburg, W. Va.
Tate Flying Service, Huntington, W. Va.
V. Wa. Sportsman's Pilot Association, Charlestown, W. Va.
Godsey-Evans Flying Service, Princeton, W. Va.

Guiding Sparks

(*Continued from page 20*)

night. For the benefit of radio fans it can be said that their radiations are non-polarized and consist of a vertical and a horizontal component. The horizontal component is reflected from the Heaviside layer, causing fading which affects the "A" and the "N" wave patterns unequally, causing the zone where the signals are equal, that is, the beam, to shift. Many loop beacons are being replaced under the present airways improvement program with modern TL stations, which send out vertically polarized signals, thus avoiding night effect. But a good many loop beacons will remain in use for some time to come.

Of course, direction-finders, too, are affected by bent radio signals. But a pilot or radio operator can check on stations in various directions, including ordinary broadcast stations. And a direction-finder pays no attention to phantom beams. It can determine the direction from which signals are coming, regardless of whether those signals are saying "N", or "A", or both together in a constant hum, or "We will now hear Tschaikovsky's Fourth Symphony."

There is much discussion just now of the place ground station direction-finders are to play in land transport. They have proved their reliability, in fact, their indispensability, in ocean air transport. It is said that in eight years of operations only one Pan American ship lost its bearings in flight, and that one was not equipped with radio.

The ocean lines use highly developed ground direction finding stations of the Adcock type, which determine the bearing of a radio telegraph signal sent from the plane. Ground men calculate the position and radio-telegraph a report back to the plane. This method saves the flight crew the trouble of making the rather involved calculations.

It is argued that the pilot and copilot of land transports have too much to do already to be bothered with taking bearings on two stations and using the triangulation method necessary to obtain a position "fix".

The pilot must first find the angle between his compass course and the direction of the incoming signals, which enables him to calculate the compass courses to the stations *from* him. Then he must calculate the courses *to* himself *from* the stations, which cannot be done merely by taking the figure 180 degrees around the compass. Because of the manner in which most charts are drawn, he must apply a correction of 0.6 degrees for each degree of longitude between his assumed position and the station, adding if west of the station and subtracting if east. Then he draws the lines out from the two stations at this corrected angle, and he will be pretty close to where the lines cross.

END

The Yanks In Spain

(*Continued from page 37*)

by the Spanish insurgents caused a stir abroad and in the United States. Contributing to the wide publicity given his capture were the dramatic appeal of his young wife, Mrs. Edith Rogers Dahl, who used to be a singer in Rudy Vallee's band, and the formal diplomatic intercession of the U. S. State Department for Dahl's release.

Only a small percentage of the American public is aware that there are from 5,000 to 7,000 American volunteers in Spain.

The American volunteers enlisted and fighting with the Spanish forces have zeal and courage, but being youngsters, they know little or nothing about soldiering. They were given some intensive training in camps near Madrid where they learned to shoot rifles and handle machine guns.

The early American volunteers had sufficient numbers to organize themselves into two battalions, the George Washington Battalion and the Abraham Lincoln Battalion. These two groups, together with other foreign volunteers, played their biggest role in November, 1936, when they saved Madrid from what was considered the heaviest offensive by General Franco's forces. Their services to the government cause were considerable up to the spring of 1937, when the equipment and the size of the Spanish army had improved and increased so rapidly.

The latest report was that, last August, a fresh body of United States youths estimated at about 870, with a sprinkling of older men who had seen service in the world war, had formed another American battalion and had had heated discussions as to what name they would adopt. Some wanted to name it the Thomas Jefferson Battalion, but the majority prevailed and named the third Yankee group the Patrick Henry Battalion.

At the beginning of the civil war the French constituted the bulk of the International Brigade of the Spanish government. The vast majority of fresh recruits hail from the United States, Mexico, Cuba and South America. As you travel through the main thoroughfares in Madrid, Valencia, you will hear accents from the Mississippi Valley, the Bronx, New England, Philadelphia, Chicago and the West Coast, and the American volunteers mingle freely with the Spanish.

The foreign volunteers almost invariably had to steal out of their own countries over obstructions erected by their governments, and when the fighting is done and these volunteers return to their respective countries they will face difficulties. This is the case with American volunteers. The writer made an inquiry to the State Department in Washington and was informed that the American citizens who go to Spain to fight have done so against the law of their country.

So they must remain anonymous even in death. The American heroism is perpetuated on a tombstone near Madrid.

END

AIR-COOLED FORD A

Conversion. 180 lbs. Runs cool. No machining. Eliminates water, radiator, low cost. Complete simple instructions, illustrated pictures 50c.
ELECTRIC MANUFACTURING, ST. PAUL, MINN.

NEW AUTOMATIC ADDER. $3.75
Makes adding easy. It's accurate, quick, durable and easily operated. Capacity 8 columns. Saves time, brain work and errors. 85,000 pleased owners. Fully guaranteed. Price $3.75 delivered. Agents wanted.
J. M. BASSETT & CO.
Dept. 34, Box 302, Altadena, Calif.

V. P. TWIN Candid-type Miniature Camera $1

A swell little camera. Made of bakelite, sturdy, compact and attractive. Easily tucked away in pocket or purse. Simple to operate. Gives clear, sharp pictures, capable of beautiful enlargements. Takes 16 pictures on standard No. 127 film. Fitted with ground and polished Meniscus Lens; view finder instantly snapped into position. Take portraits, scenics, outdoors, hobbies, still life, etc. Start splendid hobby with this little wonder camera. Mail only $1 or sent C.O.D. plus postage. Send 5c for information on how to make your own "Printing Outfit"—"Paper Cutter"—"Photo Statuettes" and complete price list of camera supplies and equipment.
HOBBY Inst., 260 Troy Ave., Brooklyn, N. Y.

THE ANSWER IS "C-D's!"

to the QUESTION: "What are the finest, most authentic flying model airplanes?" Yes, and considering quality—the most underpriced! 125 "hit" Kits, 25c, up. Also 36 new C-D Airplane-type-construction R. R. Kits that are absolutely sensational. Rush 10c at once for new 1938 complete C-D Catalog. Build REAL models!
CLEVELAND MODEL & SUPPLY CO., INC.
4508-B39 Lorain Ave., Cleveland, Ohio, U.S.A.

BRAMAN-JOHNSON, Inc.
Hangar B Roosevelt Field
Mineola, N. Y.

Dealers For
RYAN AIRCRAFT

INSTRUCTION IN
AERIAL PHOTOGRAPHY

AERONAUTICAL ENGINEERING

BECOME an Aeronautical Engineer. Tri-State College course given in 108 Weeks. Bachelor of Science degree. Graduates in Mechanical Engineering can complete aeronautical course in 2 terms (24 weeks). Thorough training in all fundamental engineering subjects. Equipped with wind-tunnel (see illustration). Non-essentials eliminated. Courses designed to save student time and money. Flying school facilities available at nearby airports. Properly trained engineers in design, research, manufacture and sales work are in demand. Enter September, January, March, June. Courses are offered also in Civil, Electrical, Mechanical, Chemical, Radio Engineering; Business Administration and Accounting. Living costs and tuition low. Those who lack high school may make up work. World famous for technical 2-year courses. Graduates successful. Write for catalog.
758 College Ave. Angola, Ind.

TRI-STATE COLLEGE

The ONE *Indispensable* Aviation Book

No one interested in practical aviation can afford to be without Lt. Col. Page's latest book, Airplane Servicing Manual. Here at last is complete guidance in every phase of servicing—a volume encyclopedic in scope, yet concise in its method of presentation and written in the clearest style. The entire aviation maintenance field is covered with painstaking thoroughness—yet the author never departs from his purpose of making the book serve as a rapid-fire, day by day guide in practical problems. There are 29 monumental chapters, copiously and graphically illustrated. The following are a few of the many subjects dealt with in every theoretical and practical detail: Machine Shop Tools and Equipment—Small Tools for the Machinist and Mechanic—Shop and Assembly Floor Equipment—Principal Materials Used in Airplane Primary Structure—Wood Working Machinery—Wood as Structural Material—Plywood and Plymetal—Airplane Wood Working Processes—Repairing Airplane Wood Parts—Gluing Practice—Wood Bending—Airplane Wing and Fuselage Covering—Fabric and Other Materials—Fabric Manipulation—Finishing and Doping Airplane Parts—Sheet Metal Shop Equipment—Welded Steel Frame Construction and Repair—Construction of All Metal Airplane Structures—Making Repairs in Sheet Metal Shop—Repairing Fuselage Parts—Landing Gear Maintenance—Oxy-Acetylene and Electric Welding Methods—Soldering and Brazing—Airplane Bracing Control Wires and Cables, Tube and Pipe Work—Aerodynamic Terms Pertaining to Flight and Rigging—Instructions for Rigging and Aligning—Periodical Airplane Inspection—Systematic General Inspection Procedure—Inspection Forms—Winter Operation of Airplanes—Airplane Engine Inspection and Maintenance—Engine Troubles and Remedies—Engine Trouble Charts—Removing and Remounting Engines in Airplanes—Aircraft Radio (Fixed Equipment).

●

for
STUDENTS
PILOTS
AIRPLANE MECHANICS
ENGINE MECHANICS
COMMERCIAL OPERATORS
FIELD SERVICE MEN

●

Comprehensively Covers
INSPECTION
TROUBLE SHOOTING
REPAIRING
RIGGING
MAINTENANCE
AIRCRAFT RADIO
and all other servicing problems

●

AIRPLANE SERVICING MANUAL by Lt. Col. V. W. Page

487 Illustrations from Photographs, Drawings and Factory Blueprints
1000 Pages (6x9) ***Sent on Approval*** **Price, $6.00**

Another Important New Publication

METAL AIRPLANE STRUCTURES By Major F. E. Loudy

Contents

●

Chapter
I TYPES OF METAL AIRPLANES
II MATERIALS OF CONSTRUCTION
III STRUCTURAL ELEMENTS
IV WELDED JOINTS
V RIVETED JOINTS
VI STRESSED SKIN DESIGN
VII TYPES OF METAL WINGS
VIII METAL WING BEAMS
IX WING DESIGN
X FUSELAGE DESIGN
XI HULL AND FLOAT DESIGN
BIBLIOGRAPHY

●

THIS volume treats comprehensively and expertly of metal construction in present day airplanes. The author's object was to make available in a single compact volume complete, up-to-the-minute data on metal airplane theory, practice and design. He analyzes and describes in detail the various types of planes, their structure and underlying principles of design, materials of construction, structural elements, welded and riveted joints, metal wings and beams, fuselage, hull and float design, etc., etc. This book is especially timely because of the increasing use of metal planes and the possibility that all-metal airplanes may soon become the universally accepted type. METAL AIRPLANE STRUCTURES gives to all concerned with practical aviation an opportunity to become thoroughly posted on the subject and to be prepared for new developments in this field. Seasoned engineers, practical shop men, and students as well, will find this book to be invaluable in their daily work. Numerous tables, formulae and engineering drawings round out the volume's usefulness. METAL AIRPLANE STRUCTURES belongs in the working library of everyone actively engaged in aeronautical occupations.

About the Authors:

LT. COL. V. W. PAGE

Has had a long and distinguished career as airplane designer, instructor and executive. His experience includes practical work with thousands of planes and engines of all different types. Col. Page's books on aviation subjects are standard texts in hundreds of aeronautical schools throughout the world.

MAJOR F. E. LOUDY

At present, Aeronautical Engineer, Office of Inspector of Naval Aircraft, Curtiss Aeroplane Div. Holder of numerous patents. Distinguished designer and constructor of all types of airships. Degrees and affiliations: Air Corps Res., B.S.E. (Ae. E.), M.A.S. M.E., A.F.I.Ae.S., E. B.

284 Illustrations & Charts 68 Tables
500 Pages (6x9) Price, $5.00

Other Authentic Aviation Books

AERIAL NAVIGATION and METEOROLOGY

***By* CAPT. LEWIS A. YANCEY**

This volume, by one of the nation's most widely experienced navigators, is recognized everywhere as standard in its field. It was written especially to aid those without technical education in gaining a good working knowledge of navigation and meteorology. Contains all the practical information required in order to pass Dept. of Commerce examinations.

350 Pages **102 Illustrations** **Price $4.00**

AVIATION ENGINE EXAMINER

***By* LT. COL. V. W. PAGE**

A systematic course of lessons in practical aero repairing in shop or field. Considers all leading types of engines and all phases of research and practical operation. Invaluable to the shop and field mechanic and to the student pilot—to all concerned with aviation construction, maintenance and repair.

440 Pages **244 Illustrations** **Price $3.00**

ABC of GLIDING and SAILFLYING

A complete guide to motorless flying. Covers air currents, study of soaring birds, description of modern gliders, training for gliding, materials used in construction, etc. Based on years of practical experience. Written in simple, non-technical language. Edited by Lt. Col. V. W. Page.

294 Pages **72 Illustrations** **Price $1.50**

All HENLEY PUBLICATIONS *Sent For Your Inspection*

The HENLEY imprint on a book is a sign of technical thoroughness and authenticity. For many years we have been publishing top-ranking authors in automotive, aviation and allied fields. No expense is spared to keep our publications up to date or to issue new titles as called for by technical progress. You can rely on HENLEY books. Take advantage now of our approval offer—all HENLEY publications are shipped subject to inspection. Money promptly refunded if you are not completely satisfied.

Use This ON APPROVAL Form Today!

***to* NORMAN P. HENLEY PUBLISHING COMPANY**
2 WEST 45th STREET **DEPT. P.A. 5.38** **NEW YORK, N. Y.**

Send me ON APPROVAL the book or books checked below. I will pay postman the prices marked (plus postage) when the package arrives, with the understanding that after 10 days' inspection I may return the book (or books) to you and you will refund my payment in full.

☐ **AIRPLANE SERVICING MANUAL, $6.00**
☐ **Metal Airplane Structures, $5.00** ☐ **Aviation Engine Examiner, $3.00**
☐ **Aerial Navigation & Meteorology, $4.00** ☐ **ABC of Gliding and Sailflying, $1.50**

Name .....

Address .....

City ..... *State* .....

☐ NOTE: Check here if you are enclosing remittance with this coupon. If so, send net price only, omitting postage which we will pay. Same ON APPROVAL and return privilege.

Everybody can build these Approved Gas Models

New TAYLOR CUB
Span, 70½" Length, 50"
Our most recent flight sensation. A beauty, in yellow with red trim. Complete kit, including M & M Air Wheels, a real buy at..... **$8.50**

ART CHESTER'S (Jeep)
Approved by Art Chester
Span, 71½" Length, 56½"
An ideal flying gas model of Art Chester's classy racer in cream with dark green trim. Complete kit, including M & M Air Wheels, for only..... **$12.00**

HOWARD D. G. A.-8
Approved by Ben. O. Howard
Span, 6'4" Length, 51"
A great gas model of a great flyer, in a rich orange and black combination. Complete kit, including M & M Air Wheels, can't be beat at this price..... **$12.00**

The SILVER FLYER
Span, 6' Length, 3'6"
A trim single seater pursuit job. Complete kit, with balsa air wheels. Only..... **$6.50**

IMPORTANT NOTE!
These kits are ABSOLUTELY COMPLETE, except for motor. Get any one of them and eliminate the necessity of having to buy a lot of extra parts. Each kit contains: all movable controls, ready formed landing gear, and motor mount, spun alum. cowls—where necessary, FULL SIZE BLUE PRINTS, license numbers and authentic markings, sheet aluminum, semi-finished wheel pants on models shown, leading and trailing edges tapered to shape on tapered wing models, all liquids (including colors), switches, bolts, screws, etc., and the majority of curved parts cut to shape; such as ribs, forms, wing-tips, etc. Such completeness will enable you to build a *finer* gas model.

OTHER GAS MODELS

The REARWIN Speedster
Span, 6' Length, 3'6"
A contest winning, nationwide favorite. Approved by thousands. Rich appearing red and silver combination. Complete kit, including M & M Air Wheels, costs only..... **$8.50**

The MONOCOUPE 90-A
Span, 76" Length, 50"
A knockout—both in flyability and appearance! Rich blue, trimmed in silver. Price of this unmatchable kit with M & M Air Wheels, only..... **$12.50**

The LUSCOMBE PHANTOM
Approved by the Luscombe Airplane Corp.
Span, 6'4" Length, 51"
All the latest improvements tend to make this an outstanding flyer. Yellow with red trim gives it a striking appearance. Price, including M & M Air Wheels, only..... **$14.00**

The STINSON RELIANT
Approved by the Stinson Aircraft Corp.
Span, 6'11¾" Length, 53"
A snappy job in black and yellow, with plenty of wing surface, to make it glide in slowly. This de luxe kit, including M & M Air Wheels, priced at..... **$14.50**

U. S. ARMY PURSUIT
Span, 57" Length, 48"
A knobby, stable, and consistent flyer, in blue, with army yellow wings. Complete kit, including colored army insignia and M & M Air Wheels, only.... **$8.00**

FAIRCHILD DELUXE RANGER "24"
Approved by Fairchild Aircraft Corp.
Span, 6'8¾" Length, 58"
Excellent flyer. Plenty of wing surface gives it a wonderful gliding angle. Gray with red trim. A truly outstanding kit, including M & M Air Wheels. Price..... **$10.00**

CUSTOM-BUILT KITS FOR PARTICULAR MODEL BUILDERS

MAIL COUPON TODAY!

AVIATION PRODUCTS Co. 619 South Federal Street Chicago, Illinois

Please rush the following kits to me today!.....

.....

I enclose $..... as payment in full.

☐ Enclosed find $1.00 deposit. Balance C.O.D. plus slight postage charges.

NAME..... ADDRESS.....

CITY..... STATE.....

Note: West of Mississippi, and Canada, add 10%. Foreign 15%. Add 5% to cover mailing costs on each kit.

Man Under the Hood

(Continued from page 26)

around the cylinder. . . . Oil pressure on the engine moves the cylinder in and out to change pitch in the air—the change coming about as a result of movements of the cam in the grooves. . . . Oil pressure is at 60 to 90 pounds per square inch.

On the groove is a high spot which limits the range of pitch for ordinary conditions. . . . But in case of failure the pilots open a valve and let fluid from the hydraulic system for flaps and wheels into the cylinder. . . . This fluid is at 600 pounds per square inch, enough to push the cam over the high spot to full feathering position. . . . The fluid is introduced at the opposite end of the cylinder to push the prop out of feathering. . . . Nifty eh, if you can follow me.

* * *

What happens to pilots who were fired by some of the U. S. airlines last winter? . . . Two of them have gone to work for K. L. M. the Royal Dutch Airline in Europe, flying from Amsterdam to Batavia all across the face of the Mediterranean and India. . . . Some fun. . . . Now we'll hear just how European operations compare with our own.

* * *

There's a lot of gossip among former domestic airline pilots about the poor job of maintenance done on a Central and South American line. . . . Several of the boys who once worked in the U. S. quit after seeing the way airplanes and engines are treated by that company. . . . One pilot who quit was offered a pass on the line toward home. . . . "Hell," says he, "think I'd ride as a passenger in a ship I'd be scared to fly?" . . . And he took the boat home. . . . This does *not* apply to Pan American Airways System, Inc. . . . Pan American itself is famed the world over for its fine operations and maintenance. . . .

* * *

From an assistant snooper in the Douglas aircraft plant comes word that none of the jigs used in building of the first DC-4 have been dismantled. . . Donald Douglas is a very smart business man. . . He knows that if the first DC-4 is successful he will, by retaining his jigs, be able to go into production immediately on this radically new airplane. . . There is a whisper—only a whisper, mind you—that Mr. Douglas already has some production orders for DC-4's. . . The whispers say that one order is from KLM. . . The whisperers also say there is another order from one of the major American transport lines. . . Another guess would be that the Army Air Corps has hinted to Douglas that he keep those jigs standing. . . The Army, you know, is very much interested in four-engined bombers. . .

* * *

Our Washington informer says the air mail legislative muddle is worse than ever. . . . The bill's been re-written so many times nobody knows what's in or out. . . . Colonel Gorrell, czar of the

airline industry, who was so hopeful for a while, is even beginning to be skeptical. . . .

* * *

A wealthy middlewestern owner of one of the new Grumman commercial amphibion airplanes was at Palm Beach. . . . The night he was scheduled to start north, homeward, he went to the airport and retired on the special bed built inside the cabin. . . . All the airport employes saw him fall asleep. . . . When the pilots arrived later, prepared to fly, they were told he was inside, so they took off. . . . Arriving at Charleston, S. C. they discovered no passenger. . . . The owner had dressed and left the ship at Palm Beach but no one had seen him go. . . . He was raving when he found he'd been left behind.

* * *

There's one corner of the Lockheed plant at Burbank, Cal., that is locked, sealed and censored with the thoroughness common to any hush-hush Army project . . .

* * *

June 1 is the day Fred Fagg leaves the Bureau of Air Commerce . . . when Secretary Roper appointed Fagg director of the Bureau, it was with the understanding that he returns to Northwestern University June 1 . . . with the resultant shots-in-the-dark as to who will replace him . . . most persistent yarn is that the new Air Commerce Director will be Casey Jones . . . on the other hand, chances are almost equal that the Bureau is about washed up . . . and U. S. civil aeronautics will go to that Federal Aviation Commission recently recommended . . .

* * *

For the time being, we'll just label this a "hazy rumor" . . . but the fact remains that certain American Airlines officials have been spending a bit of time recently up in St. Paul . . . the Minnesota city, you know, is Northwest Airlines' base . . . is American in the market for Northwest? . . . C. R. Smith, American's president, insists it's a "false rumor." . . .

* * *

Don't be surprised if you suddenly hear that Mr. Hearst's Junior Birdmen of America organization folds up . . . also the Air Line Pilots' Association . . .

END

Commemoration Edition

SWEDENBORG
LIFE AND TEACHING
By George Trobridge

Prepared in commemoration of the
250th
Anniversary of the birth of
EMANUEL SWEDENBORG

now being celebrated throughout the world. A book of 348 pages, handsomely bound in semi-limp imitation leather covers, gilt lettering and rounded corners. 25 cents postpaid; paper edition 10c. "Heaven and Hell" by Emanuel Swedenborg, 5 cents postpaid (mailing cost). Address:

SWEDENBORG FOUNDATION, Inc.
51 East 42nd Street, New York

TIME MARCHES ON!

Director of March of Time—William Spier

RADIO'S HISTORY-MAKING— HISTORY-RECORDING MARCH OF TIME!

NOW—for the first time—RADIO NEWS gives you the "inside" of this favorite national newsfeature! How was it possible for a presentation of the Hindenburg disaster to be prepared only two hours before broadcast time . . . orchestra and sound to provide illusion of storm . . . explosions . . . frenzied cries . . . crackling flames . . . crumpling girders . . . an auditory "scoop" when only barest bulletins were available?

NOW—you may "sit through" the dramatic preparation of the March of Time program! How are the voices so accurately duplicated? Where is this unusual "voice talent" found? Do you know how many voices are auditioned every year? How are the thrilling, diversified sound effects produced? Do you know how many seconds of preparation are spent for each second of the thirty-minute program? You will be amazed to learn about these heretofore concealed tidings of the March of Time! Don't miss this inspiring article . . .

A FEW FEATURES IN THE MAY ISSUE

- Microphone Manners
- Within Earshot Of The Editor
- Airline Radiomen
- Spanish War & Radio
- Short Wave Propaganda War
- Not For Rebroadcast
- The Photocell
- And Many Others

RADIO NEWS

Now On Sale At All Newsstands

MAIL COUPON BELOW!
SPECIAL INTRODUCTORY SUBSCRIPTION OFFER

RADIO NEWS, 608 South Dearborn Street Chicago, Illinois
6 Issues of the New Radio News for $1
Enclosed find one dollar. Please start my subscription with ..... issue.

Name ..... Address .....
City ..... State .....
(Foreign postage 50c extra)

BUYERS' DIRECTORY

RATES: $7.00 per inch

AIRPLANES FOR SALE

LEARN TO FLY in your plane. The flying ground trainer. Eligible in every state in the Union. Shipped with a sealed throttle, oversize air wheels. Sled runners for winter use. Detach wings and use as high speed ice sled. Welded steel tube construction. Equipped with 40 h.p. aircraft motor. Easy payments, only $12.50 down. Rush 25c for illustrated information.
Universal Aircraft Co., Ft. Worth, Texas.

AIRPLANE SUPPLIES

HEATH AIRCRAFT SUPPLIES
Sales Folder Sent FREE

Heath Birch Untipped Propeller, B-4 or Henderson.$11.95
Heath Birch Metal Tip. Prop., B-4 or Henderson. 16.95
Heath Untipped 4 ft. Ice Sled Propeller..... 3.95
Heath Birch Metal Tipped Continental Propeller.. 29.95
Heath Birch Metal Tipped Ford Propeller..... 21.00
HEATH MOTOR MANUAL, complete data on conversion, overhaul, trouble shooting, timing, operating, clearance chart, and parts price list. Invaluable to Heath and Henderson motor owners, $1.00 prepaid or C. O. D.
HEATH LIGHTPLANE AND KIT LITERATURE 10c
HEATH AVIATION CO., BENTON HARBOR, MICH.

PROPELLERS

PROPELLER SPECIALS. Stainless steel. Double tipped on genuine linen base. Selected dark mahogany imported propeller stock. Save 300% and buy the finest propeller possible to produce. **Order from this ad.**

4' Harley & Indian Motors.....$ 9.95
4'6" Heath Henderson..... 12.60
5' for all 35 h.p. motors..... 14.85
5½' Fords, Lawrence, Anzani..... 16.65
6' Fords, Chev., 45-50 h.p. motors..... 18.00

We have lower priced propellers 98c up. From factory direct to you. Literature free. **Universal Aircraft Co., Ft. Worth, Texas.**

BOOKS

STUNT

A COMPLETE BOOK by Lieut. Joe Mackey. America's finest Stunt Pilot. Gives exact method for every stunt from wing-overs to outside loops. Fully illustrated. Price $1.00. Literature Free.
The AIRCRAFT DIRECTORY
Athens, Ohio

AERO BLUE BOOK

Gives specification of over 400 airplanes and nearly 150 aero engines; appraised value of many second hand planes; valuable points on buying used planes; data on choosing a flying school. Only information of its kind ever compiled. Priceless to students, engineers, dealers and flyers. Send $1 (money order or currency).
AIRCRAFT DISTRIBUTING CO. **Dept. 5-PA** **1480 Arcade Bldg., St. Louis, Mo.** **$1.00 Prepaid**

Aviation Books

Complete Stock of Books on All Aviation Subjects.
Send for Catalog.
GOODHEART WILLCOX
2009 So. Michigan Ave., 5-PA, Chicago, Ill.

LIGHTPLANE DESIGN
The Fact-Book for the Home-Builder
APPROVED BY EXPERTS
Sold With a Money-Back Guarantee
WRITE FOR FREE LITERATURE
WALTER H. KORFF, Aeronautical Engineer
P.O. Box 5304—42nd St. Station INDIANAPOLIS, INDIANA

Classified

RATE: 15c per word MINIMUM: 10 words

AIRPLANES FOR SALE

$35.00 Up. Numerous airplanes, motors, parts. Licensed, unlicensed flyables, damaged repairables. Low installments. Trades. Reliable listings, 25c. Box 462, Port Huron, Michigan.

1937 WELCH for sale, never used, $785.00 Garwood, 13501 Compass, Detroit.

LICENSED American Eagle, OXX6, 3 polb. Priced $310.00. B. Rivers, 2514 W. Burleigh Street, Milwaukee, Wisconsin.

FOR SALE—PEITENPOL AIR CAMPER. Steel fuselage. Best offer takes. R. Vesely, 544 So. York St., Elmhurst, Illinois.

AIRPLANE SUPPLIES

SALE—Henderson motor converted, Claude Brewster, 742 Grove place. Toledo, Ohio.

HEATH high efficiency metal propeller cheap. A. K. MILLER, Montclair, N. J.

CYCLONE motor accessories, $7.50, guaranteed. Russell Tracy, Pitman, N. J.

WANTED: Serviceable or partly damaged fuselage for 1932 Taylor Cub. W. Keiling, R. F. D. No. 1, Box 11, Frostburg, Md.

FOR SALE—One pair of Corben Super Ace wings, licensable, Arch Tucker, 2469 Ridge Rd., West Rochester, N. Y.

GLIDERS

MEAD Primary Glider like new. Rebuilt to licensing requirements, $75.00. Five wheel landing gear, $20.00. Clarence Stein, Kutztown, Pa.

WANTED—Glider, primary preferred. Send Particulars. Ed. Stumpf, Ontarioville, Ill.

MODEL AIRPLANE SUPPLIES

Now the new SINGLE BLADE propeller for gas jobs. A noticeable improved performance for $1.00. Gas model pontoons complete $4.00. Make your gas model more realistic with a pilot, $0.60 each. Postage paid.
E. A. DONAR
1921 Sceville Ave. Berwyn, Ill.

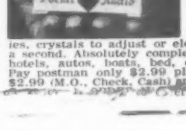
INSTRUCTION

IF YOU HAVEN'T GOT $1000 skip the DeLuxe schools. Our big old brick building resembles an auto wrecking yard. The teacher really knows airplanes, mechanics, engineering. There's all the equipment you need to work with. No frills but you can get theory as well as practice. Sheet Metal, Welding, Drafting, Stress Analysis, Wing Construction. Write for further particulars, also tell about yourself.
Aircraft Trade School, Lawrence, Kan.

MISCELLANEOUS

ALUMINUM ALLOY PISTONS

For all makes and models of **MODEL, AVIATION, MIDGET,** outboard, marine, automotive, motorcycle, diesel and industrial motors. Finished and semi-finished . . . any oversize. Wrist pins.
Catalog on request.
JUDSON MFG. CO.
Hedge & Gillingham Sts.
Philadelphia, Pa.



NEW! MIDGET RADIO
World's Smallest Real Performing
RADIO Amazing midget weighs only 3 ozs. complete. Receives stations with beautiful, clear tone. Little interference. New design patented. Tunes broadcast band and some short wave. No tubes, batteries, crystals to adjust or electric connections. Hooks up in a second. Absolutely complete with instructions for use in hotels, autos, boats, bed, office, etc. **SEND NO MONEY.** Pay postman only $2.99 plus postage, on arrival or send $2.99 (M.O., Check, Cash) and yours will be sent post-paid. 5-Day trial offer. Order several at each kit.

MODEL AIRPLANES

ALL Suppliers to Model Aircraft Industry are requested to contact advertiser with view to establish trade relations. Write details of product to Box 800, POPULAR AVIATION, 608 S. Dearborn, Chicago.

HAND CARVED—Props for Gas Jobs. 12 to 18 inches. High Gloss Finish. $1.00 Each—Postpaid. Blanks—Six for $1.00. E. Cavanough, 1539 E. Montgomery Avenue, Philadelphia, Pennsylvania.

INSTRUCTION

AVIATION APPRENTICES, GOOD PAY—BIG Future. Write immediately, enclosing stamp. Mechanix Universal Aviation Service. Strathmoor Station, Dept. B-2, Detroit, Michigan.

LIGHTPLANE DESIGN CONSULTATION SERVICE. Free literature. Peyton Autry, Boonville, Indiana.

AVIATION EMPLOYMENT SERVICE for inexperienced workers. Salaried jobs available. Details for stamp. Desk "G" Airployment, Box 553, West Los Angeles, Calif.

"Opening, limited number of selected young men with $180.00, work board, balance flying time, radio beam, blind flying, aircraft radio license, commercial license. Noll Flying Service, Bellefonte, Pa."

SCHOOL of Aeronautics—Welding, Drafting, Swallow Airplane Company, Wichita, Kansas.

YOU CAN BECOME a graduate airplane mechanic in ten weeks at $1.00 per week! Free catalog. Home training. United Air School, Box 528, Elgin, Ill.

SITUATIONS WANTED

WANTED—Job as parachute jumper. Name own terms. Please write. R. Bolder, New Rockford, N. D.

DESIRE flying job. M.S. in E.E. '31, honors. Commercial pilot cert. Good health, references, single. Radio & Contr. prop experience. Box 900, POPULAR AVIATION, 608 S. Dearborn, Chicago, Ill.

MISCELLANEOUS

BLONDIN'S Aircraft Chart. Names, dates, records, and 94 pictures, $1.00. Blondin Chart Co., Box 34, Los Angeles, California.

WANTED—Automobile, 1936 or 1937 model in exchange for flying course and cash. Box 10, POPULAR AVIATION, 608 S. Dearborn, Chicago.

WANTED—Original poems, songs, for immediate consideration. Send poems to Columbian Music Publishers Ltd., Dept. K51, Toronto, Can.

COMPLETE plans, drawings for building man carrying Glider, 25c. Federal, Box 314, Dept. 11, Indianapolis, Ind.

PROPELLERS — Sled-Airplane, lowest prices. Catalog 10c. Woodcraft Propellers, Hillside Station, Wichita, Kansas.

PATENTS

WE SUCCESSFULLY SELL inventions, patented and unpatented. Write for proof, and tell us what you have for sale. Chartered Institute of American Inventors, Dept. 119, Washington, D. C.

PATENTS—Low cost. Book and advice FREE. L. F. Randolph, Dept. 372, Washington, D. C.

NOTICE!

Special rate for readers (non-commercial) who wish to buy, sell or exchange airplanes, aeronautical equipment or supplies. 10 words for 50c, extra words 15c. Payable in advance.

Cadet Days at Kelly Field

(*Continued from page 32*)

half an hour. Just now we're winding up in a steep Lufberry—three planes spaced around a small circle. The leader rolls out and heads straight away. We watch closely for the assembly signal but he doesn't rock the wings of his ship. It's a rat race. We're off. He does a slow roll. We follow suit.

In rapid succession he goes through four or five maneuvers which we (ha! ha!) duplicate. It's the old game, you see, of follow the leader. Today, we finish up by "threading the needle." The leader pulls up in a long loose loop. I follow with Jackson closely behind me.

There we are—three planes looping—one behind the other. The leader dives out of this "squirrel cage" and does a loop at right angles *through* our loop. This is "threading the needle." This is the last number for the day as the leader rocks his wings—we assemble, come on in and land.

Comes now the most humiliating point in my narrative. Everybody, at some time or other, pulls a boner which two or three people see. Mine, however, had to be in front of half the pursuit section. It was on the maintenance trip. Probably I should stop here and explain what the maintenance hop is, but don't think I'm trying to change the subject—I'll come back to it later.

The purpose of this trip is to give us an idea of how much time a mechanic has to spend on an airplane. During the four day trip each student cares for his own ship. El Paso was the overnight stop on the first leg.

The field there is actually two fields connected by a small strip, with a civilian field on one side, the army field, which is marked by a dirigible hangar—on which the word ARMY is painted with 75 foot letters,—is on the other side. So it was perfectly natural, I thought, to sail right by and make a landing on the civilian airport where I didn't belong, instead of the army airport where I did belong.

The reception party was waiting for me when I taxied up, and I was presented with a tasteful little trophy which is awarded every year for the prize job of navigation on this trip. I wasn't going to mention this at all but some well-meaning friends sent in the picture so I figured some sort of explanation was necessary.

We made Dallas on schedule the next day only to run into a three day lay-over caused by a rainstorm which not only made flying impossible but mired the planes hopelessly in the mud. We got our required three hours of athletics that week when we all pitched in and lifted and hauled the planes out to solid ground on the runways.

Although we were scheduled to land at Houston and Corpus Christi, unfavorable weather at the two points made it necessary to come straight back to Kelly.

If I didn't learn anything else on the maintenance hop, I did acquire a healthy respect for the grease monkeys who keep our planes in such excellent condition. For every hour an army ship flies, the mechanics work at least an hour on the ground.

After our return from the maintenance trip we've been polishing up loose odds and ends, with most of our work over. The next big moment is graduation. As a general thing I think most school graduation exercises are a pain in the neck. But here we put on what I believe to be a pretty good show.

All the visiting dignitaries and the general populace line up along the flying line and we all fly by in review. There will be some 60 planes this time. All of us will be in there trying to fly the best formation of our lives to put on a good show for the folks, and I think we will.

Then we'll go up to the post theatre to get our wings and our diplomas, and a year of my life will be over. It's been a full year—full of chills, thrills, and hard work and I wouldn't exchange it for any year I've ever had or hope to have.

END

THIS concludes a series of articles written exclusively for POPULAR AVIATION by Lieutenant Hays as he passed through the successive stages of training at Randolph and Kelly Fields. This series has not only been highly interesting to our young and aspiring aviation fans but it has had a great educational value.

We were very glad to have the author call at our office while on his way to join the U. S. Army Air Corps pursuit group at Selfridge Field, and found him a most interesting and likeable chap, representative of that great group of which he is now a member.

LUSCOMBE SCHOOL OF AERONAUTICS

West Trenton - N. J.

Specialized Training in Metal Airplane Engineering and Construction

Get Your Start in Aviation by Writing for Details NOW Given in Our Free Folder

"OPPORTUNITY IN AVIATION"

AVIATION APPRENTICES

BIG PAY GOOD FUTURE

If you are interested in working yourself into a highly paid position in Aviation under our Apprentice-Plan—Write, immediately, enclosing stamp—

MECHANIX UNIVERSAL AVIATION SERVICE CO.

Strathmoor Sta., Dept. B, **Detroit, Mich.**

MEGOW Gas-Powered MODELS for Big-Plane Performance

From the famous QUAKER FLASH straight through a most comprehensive line, Megow leads in gas-powered model kits! All kits are remarkably complete in detail, with large, easy-to-follow plans. For instance, the gas-powered SCALE MODELS listed below are complete with cut-to-shape ribs, formers, wing, elevator and rudder tips, spun aluminum motor cowl, formed landing gear and motor mount. All parts, switches, sheet aluminum, semi-finished leading and trailing edges, semi-finished wheel pants, streamlined rubber wheels, license numbers, etc., are included.

QUAKER FLASH $4.95 plus 30c post.

Uses any model airplane engine you prefer. Easily carried in car. Adj. rudder, semi-adj. stabilizer. Motor easily removed. 3¼ in. rubber wheels. Wingspan 67 in.

STINSON RELIANT

MONOCOUPE

MONOCOUPE 90. Scale 2 7/16 in.—1 ft. Span 76⅛ in.....$12.50
TAYLOR CUB. Scale 2⅛ in.—1 ft. Span 79⅛ in.....$8.50
ART CHESTER "JEEP". Scale 4 in.—1 ft. Span 71½ in.....$12.00
HOWARD DGA8. Scale 2 in.—1 ft. Span 76 in.....$12.50
U. S. ARMY PURSUIT. Scale 1⅝ in.—1 ft. Span 59½ in.....$8.00
STINSON RELIANT. Scale 2 in.—1 ft. Span 83¾ in.....$14.50
SILVER FLIER. Span 72 in. Length 40 in.....$6.50
FAIRCHILD DELUXE RANGER "24". Scale 2¼ in.—1 ft. Span 80¾ in.....$10.00
LUSCOMBE PHANTOM. Scale 2½ in.—1 ft. Span 76 in...$14.00

(By mail 50c postage additional)

Send for Catalog Today

—showing scores of airplane and ship models; model speed boats, O-Gauge Freight Cars, ready-made parts and supplies for constructive hobbycrafters. Mailed for 5c postage.

MEGOW'S

Howard & Oxford Sts. Philadelphia, Pa.
or 217 N. Desplaines St. Chicago, Ill.

FIRST BOOK IN AERO ENGINEERING:

Simple Aerodynamics

4th Revised Edition by Colonel C. C. Carter, U. S. Military Academy, West Point. 595 pages, 395 illustrations, **$4.50.**

This famous textbook is used by the Army cadets at West Point and by students in over 100 leading technical schools, colleges, and flying schools.

It provides a clear and easily understood explanation of the fundamental aerodynamics involved in the design and operation of the airplane. It shows, for example, how to make the necessary calculations to estimate the performance of a particular plane under various conditions.

The scope of the book ranges from the explanation of the fundamentals of air flow and production of lift to the complete airplane, its stability, maneuverability and performance.

ENTIRELY WITHOUT MATHEMATICS:

Principles of Aerodynamics

by Max M. Munk, Ph. D., Dr. Eng., formerly in charge of Aerodynamics Research for the N.A.C.A. 252 pages, 62 illustrations, **$3.00.**

Written in simple language without any mathematical detail, this book is a reliable guide to a logical understanding of the principles of aerodynamics. Dr. Munk is a world-renowned authority—no aircraft is designed without some direct or indirect use of theories and methods originated by him. His remarkable book makes crystal clear the basic ideas underlying many of the most complex design formulas. Its 7 parts include: General Aerodynamics, Wing Section Theory, Wing Theory, Experimental Aerodynamics, Propeller Theory, Applied Aerodynamics.

SIMPLE, PRACTICAL METHODS:

Aircraft Propeller Handbook

by Karl H. Falk, Chief Blade Designer, Hamilton Standard Propellers Division, United Aircraft Corporation. 62 illustrations. **$4.00.**

Up to this time, information on propellers has been so highly theoretical as to be of little use in actual day-by-day work. Now this book supplies a very practical method, simplified to the utmost so it can be used by students as well as by experienced men. Eight chapters contain simple equations and "worked out" examples; they cover: Propeller Design. Aerodynamic Characteristics. Vibration. Static, Gyroscopic Characteristics. Twisting Moments. Strength of Propellers. Selection of Propeller.

Fill in, tear out, and mail

Sent on 5 Days' Approval

The Ronald Press Company

Dept. M187, 15 East 26th St., New York

Send me the books checked below. Within five days after their receipt I will either return them or send payment in full at the prices shown, plus a few cents for delivery. (We pay delivery charges when cash accompanies order—same return privilege.)

- ☐ **Lusk, Aeronautics** $3.25
- ☐ **Falk, Propeller Handbook** 4.00
- ☐ **Moors, Engine Mechanics Manual** 4.50
- ☐ **Hartz-Hall, Rigging Handbook** 3.50
- ☐ **Munk, Principles of Aerodynamics** 3.00
- ☐ **Carter, Simple Aerodynamics** 4.50
- ☐ **Ramsey, Navigation of Aircraft** 4.50
- ☐ **Barnaby, Gliders and Gliding** 2.50

Name .....

Home Address .....

City ..... State* .....

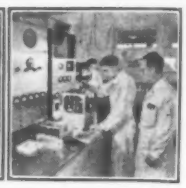
☐ Employed by,

☐ or Reference .....

Address .....

* Outside continental U. S. and Canada, cash plus 25c per book for shipping.

☐ **Check here if you wish our Catalog of Aeronautic Publications, FREE.**



Can you answer these test questions?

What is meant by compression ratio and how does it affect the power rating of an engine?

The compass reading is 230°, the variation is 18°E, the deviation is 7°W. Determine the true heading.

What is the purpose of a condenser in the ignition system? In which circuit is it located?

What would you do to get a plane out of a tail-spin?

What is the approximate error in the air speed reading for an increase in elevation of 3,000 feet?

How is the torque of the propeller balanced in rigging a plane? Why is the vertical fin sometimes slightly offset?

What are 8 significant landmarks that are shown on good avigation maps which may be identified easily from the air?

If your engine started missing on one cylinder, where would you look for the trouble?

How may a pilot correct for drift without a drift indicator?

What are the four basic cloud forms? What is the approximate altitude at which they occur? What flying conditions do they indicate?

In flying out of a small field, is a small or large propeller pitch desirable?

What is the effect of having an adjustable stabilizer too high when landing?

Will prepare you for any Pilot's or Mechanic's Certificate Test:

Aeronautics

A Ground School Textbook

by HILTON F. LUSK

Formerly Dean, Boeing School of Aeronautics

420 Pages, 175 Illustrations, 226 Test Questions, $3.25

THIS is a complete ground school course in handy book form. It clearly and thoroughly explains all the subjects you need to understand to pass the written part of the government examination for a certificate as an airplane pilot in any of the grades—including transport pilot, or as an airplane or engine mechanic. No one who masters this book will have any difficulty in answering any questions that may be asked in the government tests. So clearly and simply written that you will have no trouble in grasping its explanations even if you must study at home without the aid of an instructor.

CONDENSED OUTLINE

Principles of Flight: Explains all the essential aerodynamic factors and their application to airfoils.

Airplane Construction and Operation: Principles of construction and materials employed. Methods for working wood and fabric. Welding metal planes and parts. Flying. Elementary acrobatics.

Propellers: Theory, Construction and maintenance of wood and metal propellers. Variable pitch propellers.

Engine Construction and Operation: Theory. How to determine engine efficiency. Types of engines, construction materials. Fuel systems, carburetors, ignition systems. Engine operation and maintenance.

Blind Flying Instruments: Use of attitude instruments in blind flying. Absolute and relative references. Inclinometers. Pitch, roll, turn indicators. Operating principles of gyroscopic instruments.

Engine Instruments: Construction and operation of tachometers, pressure gages, thermometers, fuel quantity gages, etc.

Safety Appliances: Parachutes. Aircraft radio, antenna details, shielding methods, etc.; radio range-beacons and markers.

Avigation Maps and Piloting: Explains and illustrates various map projections and their use in avigation. Practical hints on piloting.

Dead Reckoning: Details of methods of dead reckoning with solutions of practical problems.

Avigation Instruments and Equipment: Describes and illustrates each of the avigation instruments found in aircraft and explains theory so you can understand principles on which it operates.

Principles and Applications of Meteorology: Effects of winds, storms, visibility in relation to flight.

ON FABRIC-WOOD PLANES:

Airplane Mechanics Rigging Handbook

by R. S. Hartz, formerly Lieut. Colonel, Air Corps, U. S. Army; and **Lieut. E. E. Hall,** formerly Editor, "Aircraft Servicing." 267 pages, 104 illustrations. **$3.50.**

This book covers in detail the care and handling of fabric planes with wooden struts and spars—on the ground and in the shop; sequence of rigging steps; how to true up the assembled ship; how to adjust the wings and control surfaces for "hands off" flying; spars and struts; inspection; installing and checking compasses; fabric; wood and glue; metal parts; wire; dopes and doping; folding and packing parachutes.

BEST PREPARATION FOR POWERED FLIGHT:

Gliders and Gliding

by Ralph S. Barnaby, Lieut. Comdr. (C. C.) U. S. Navy, Scientific Section, Bureau of Aeronautics. 182 pages. 123 illustrations. **$2.50.**

A practical handbook for glider flyers and builders. Gives a detailed, progressive course in flight training, with full information about types of gliders, ground and wind conditions, launching, first flight, maneuvering the glider, and landing. Starts with primary instructions and progresses through secondary training to a full course in soaring. Contains useful data on design principles, structural details, materials, assembling, rigging, aligning.

A COMPLETE ENGINE COURSE:

Aircraft Engine Mechanics Manual

by C. J. Moors, Chief Instructor, Department of Mechanics, Air Corps Technical School, U. S. Army. 511 pages. 189 illustrations. **$4.50.**

Covers the same ground as the course given the enlisted mechanics of the Army Air Corps with the addition of much data on types of equipment adapted only for commercial airplanes. It deals thoroughly with all kinds of aircraft engines and their accessories.

Mr. Moors gives all needed data on construction and operation, supplies full instructions for proper maintenance, and shows you exactly how to go about making any necessary repairs and adjustments.

A PRACTICAL GUIDE FOR PILOTS:

Navigation of Aircraft

by Lieut. Comdr. Logan C. Ramsey, U. S. N.; formerly instructor in Aerial Navigation, Pensacola Air Station. 237 pages. 51 illustrations. **$4.50.**

Covers the practical, everyday sort of navigation every pilot must know. Emphasizes dead reckoning, including plotting, course setting, determining and correcting for wind effects, etc. Piloting and navigation by aerial astronomy are also fully explained. In addition to its major presentation of principles and practice of position finding by calculation and observation, manual covers maps, instruments, accessories; compasses; navigational practice.